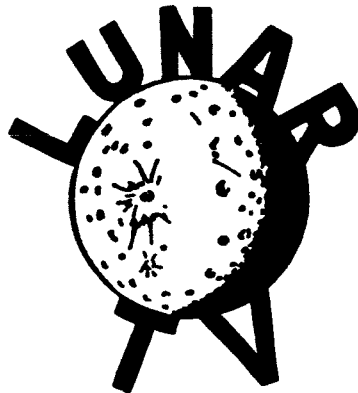


1955A



QUALITY
PROGRAM
PLAN

18 December 1964

CONTRACT NO. NAS 9-3548

By

WESTINGHOUSE ELECTRIC CORPORATION
Aerospace Division
Baltimore, Maryland

WESTINGHOUSE APPROVAL	DATE
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PRODUCT RELIABILITY DIR. LUNAR TV CAMERA <i>Quintin Weaver</i>	6-14-65

REVISIONS

REVISION	DATE	PAGES AFFECTED
A	25 May 1965	All Pages

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SECTION 1

INTRODUCTION

1.1 GENERAL

The provisions herein constitute the Quality Program Plan of the Aerospace Division of Westinghouse for implementing the contractual requirements set forth in NASA document NPC-200-2, "Quality Program Provisions for Space System Contractors". This quality program plan encompasses all phases of the Lunar TV Camera from the design conception to the delivery of articles meeting the quality level of the intended design. Coordination of all activities and implementation of the plan is the responsibility of the Director of Product Reliability. The contractual quality program plan requirements are implemented in accordance with the Reliability and Quality Assurance Policy Manual (see note).

1.2 APPLICABILITY

This quality program plan, when approved, is the contractual document for the conduct of the quality program effort on the Lunar TV Camera.

NOTE: Copies of the Reliability and Quality Assurance Manual were forwarded to NASA-MSC as part of the Lunar TV Camera Proposal package in May of 1964.



The following exceptions to the provisions of this document are applicable to the fabrication of Service Test Model (STM) No. 1:

- a. Parts and materials are purchased to drawings, catalogue information, or drawn from ledger stock. These parts are electrical equivalents of approved parts used in the fabrication of subsequent cameras.
- b. These parts and materials are not assigned inspection lot numbers.
- c. Program inspection and test procedures prepared for subsequent cameras are used on STM-1 where established and available.
- d. Functional and acceptance testing is conducted jointly by Product Reliability and Engineering technicians under the direction of Project Engineering. Test equipment is provided by Project Engineering.
- e. The STM #1 Acceptance Data Package will consist of:
 - Camera serial number
 - Camera weight
 - End item inspection and test data sheets
 - Failure and corrective action reports
 - Repairs and replacements data
 - Configuration list



1.3 RELATION TO DETAIL REQUIREMENTS

The program plan described in this document is intended to comply with the NASA Specification entitled "Exhibit A - Specification - Television Equipment - Apollo Spacecraft" and NPC-200-2 referenced therein. Specific requirements of the camera specifications are referenced by paragraph number in this document. If any conflict exists between this quality program plan and the contract, the contract will have precedence.

1.4 RELATION TO RELIABILITY REQUIREMENTS

The provisions herein are intended to aid in achieving the reliability requirements of the NASA camera specifications. This document complements the Westinghouse Aerospace Division Reliability Program Plan prepared for the Lunar TV Camera in compliance with NASA NPC-250-1 and is used to effectively support the reliability effort. Nothing stated in this document is interpreted to preclude compliance with the Reliability Program Plan for this program or NPC-250-1.

1.5 GOVERNMENT QUALITY ASSURANCE ACTIONS

Westinghouse recognizes the right of NASA-MSC or its designated representative to inspect, audit and review the quality program of Westinghouse Aerospace or its subcontractors. The rights of the Government are included as a part of the reliability and quality controls applied to subcontractors on this program.



1.6 REVISIONS

Any revisions to NASA specification NPC-200-2 will be considered a contract change and negotiated with NASA-MSC. Any revision to the specification is reviewed by Product Reliability and all other affected Westinghouse Aerospace departments. If Westinghouse Aerospace elects to implement the revised document without a contract change, NASA-MSC will be notified in writing.

Westinghouse subcontractors are notified of any changes to procurement specifications resulting from NPC-200-2 revisions. Subcontractors are requested to submit what effect, if any, the change has on price and/or delivery.



SECTION 2

BASIC REQUIREMENTS

2.1 GENERAL

The quality plan as detailed in this document, plus any supplementary procedures required, ensures that quality requirements of the contract are continuously maintained. Product Reliability participates in initial program planning, schedules, customer specification review, vendor surveys, design reviews, provide quality inputs for procurement documents, prepare test and inspection procedures, perform quality audits, and implement corrective action when the quality of the article is marginal or unsatisfactory. Thorough documentation is made of all quality functions such as inspections and tests. Records other than those delivered to the customer are filed and available as information to NASA-MSC or its designated representative upon request.

2.2 QUALITY PROGRAM DOCUMENTATION

Product Reliability develops and provides quality documentation as outlined in this quality program plan. Quality program documents such as process control, inspection and test procedures developed specifically for the Lunar TV Camera program are uniquely identified as such and submitted for the NASA-MSC actions described in the following paragraphs.



All special documents for the camera program are kept separated from other common documents.

Existing Aerospace procurement, inspection, calibration, failure reporting, MRB, and other quality forms are used to implement the quality assurance program during the design, procurement, fabrication, and test of the camera. Station instructions are written describing the use of these forms. They are maintained in files which are readily available for use by the inspectors or testers. Sample copies of the documents are referenced and illustrated in this quality plan. Documentation has been categorized as Type I (Approval), Type II (Review), and Type III (Information). This classification was established during NASA-MSC - Westinghouse Management discussions held on 7 July 1964 at the Aerospace Division. All documents to be submitted are categorized and a time schedule provided in Appendix A. All documentation is subject to actions of NASA-MSC as explained in the following paragraphs.

2.2.1

Approval (Type I)

Westinghouse Aerospace is granted approval in writing within 3 weeks after NASA receipt of document. If a disapproval notice is not received prior to the end of the 3 week period, the item is considered to have been approved.



2.2.2 Review (Type II)

Documents in this category are delivered by Westinghouse as stated in Appendix A. If Westinghouse has not been notified of disapproval within 2 weeks after NASA receipt, operations shall proceed in accordance with the document as delivered.

2.2.3 Information (Type III)

All documents in this category are submitted for information regarding quality provisions of in-process test and/or inspection procedures, process control procedures, and test equipment checkout. Quality Status Reports and Summaries of corrective action taken as the result of quality audits are also provided.

2.3 CHANGE CONTROL

2.3.1 General

Procedures for the control of all documents affecting camera quality are as follows:

The Engineering Department is responsible for initiating the Revision Notice (R.N.) Form BA-5376-1, (Figure 2-1). The Revision Notice procedure is documented in the Engineering Manual, Division 5, Section A-1 (see note) and is summarized herein. The Revision Notice can be written against a drawing, spares bill of material, test specification, Purchasing Department specification, R-Specification, process specification, or finish specification.

NOTE: The Revision Notice Procedure is included in the Lunar TV Camera Proposal Addendum (page 5-25).



1. DISTRIBUTION				MAIL SHIP. NO. OF COPIES. PERSON / DEPT.				3. MODEL SHOP <input type="checkbox"/>		4. PRODUCTION <input type="checkbox"/>		5. LOWWAY SERIALIZED ASBY.	
								4. EQUIP / UNIT		5. NEXT HARBOR ASBY.			
								6. DISPOSED PARTS/MAT'L		7. A. NON INTERCHANGEABLE			
								<input type="checkbox"/> USE <input type="checkbox"/> SCRAP <input type="checkbox"/> REWORK		B. TWO-WAY		C. ONE-WAY	
8. PART NAME / ITEM													
13. REASON FOR CHANGE		12. PURCHASING/MARKETING		11. PROD. RELIABILITY		10. MFG. ACTION		9. DPTS. ACTION					
14. PROD. SHOP ORDER		15. BREAK IN POINT		20. GENERAL ORDER NO.				25. APPROVED		SIGNATURE		DATE	
				21. ENGR. CHARGES				ORIGINATOR					
				TYPE G. O. NO. CONTROL SPENDER				EXT.					
								SUPERVISOR					
								M. E. / I. E.					
								MSE - SPARES					
16. SPARES SHOP ORD. NO.		17. BREAK IN POINT		22. REVISION REQUESTER				DATE		CUSTOMER			
										DESIGN ACTIVITY			
				APPROVED <input type="checkbox"/>				REJECTED <input type="checkbox"/>		26. DWS. NO.		REV TO REV	
18. M. I. ACTION				23. AUTHENTICATING DOCUMENT				REV. CLASS		DATE RECORDED			
				E. C. P. NO.				1 <input type="checkbox"/> 2 <input type="checkbox"/>					
				OTHER:									
				24. COST AND DELIVERY ANALYSIS						27. HOLD <input type="checkbox"/>		HOLD RELEASE <input type="checkbox"/>	
				TEST EQUIPMENT AFFECTED				YES <input type="checkbox"/> NO <input type="checkbox"/>		EXPECTED HOLD RELEASE			
				ROUTING AFFECTED				YES <input type="checkbox"/> NO <input type="checkbox"/>		REVISION NOTICE NO.			
				TOOLS AFFECTED				YES <input type="checkbox"/> NO <input type="checkbox"/>					
19. COMPLETE REVISION CONSISTS OF				TO						SHEET 1 OF			
REVISION NOTICE													

BA-5376-A-3

1955A-PF-3

Figure 2-1. Revision Notice



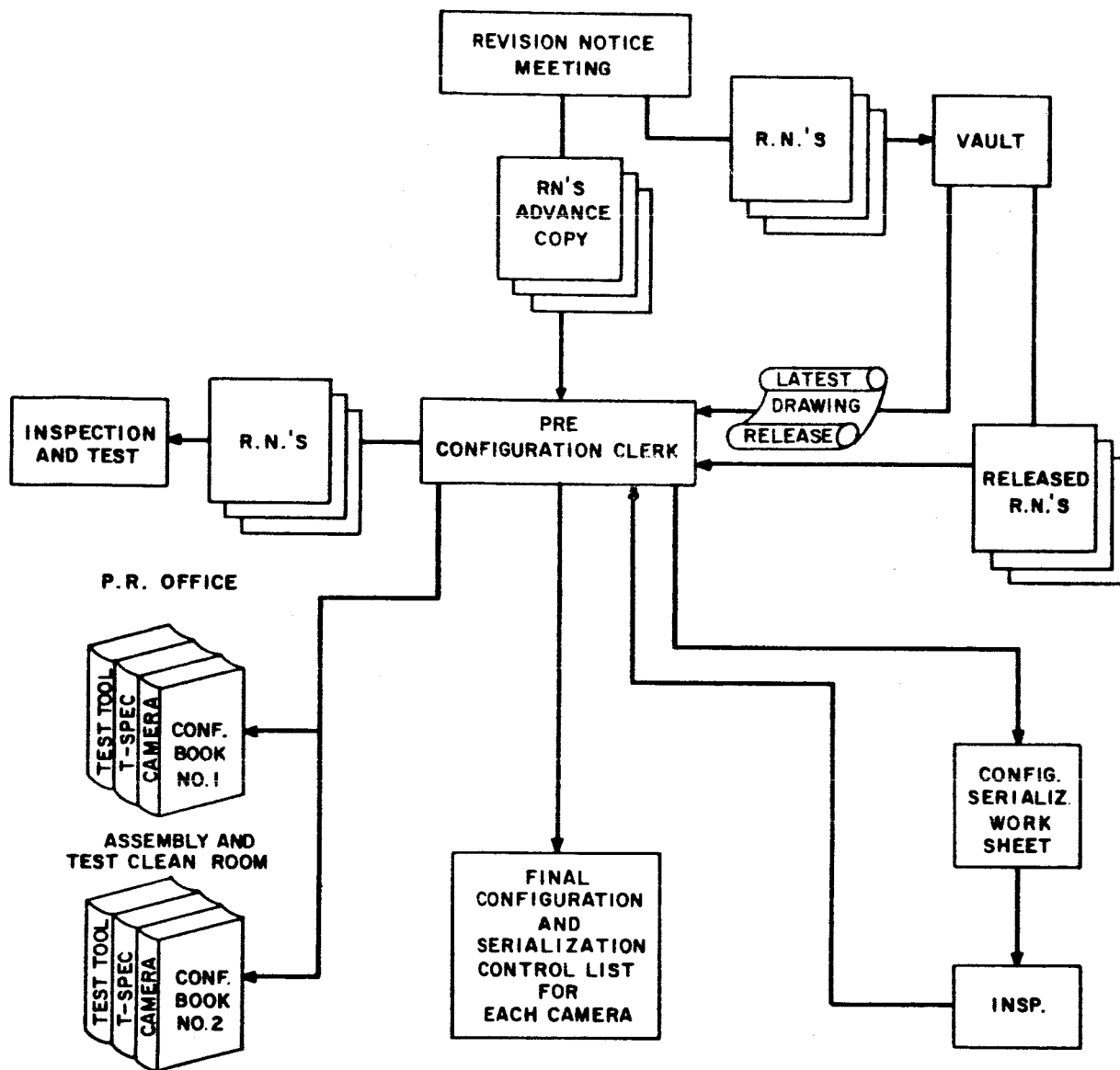
The Revision Notice initiates and accomplishes the following action, either directly or indirectly:

- a. Authorizes drawing changes
- b. Authorizes the use of new drawings
- c. Changes specifications
- d. Authorizes the use of new specifications
- e. Authorizes Manufacturing to make equipment changes in the shop.
- f. Initiates changes to purchase orders and AOA information
- g. Authorizes the use, rework, or scrapping of parts, materials, and tools
- h. Initiates changes to tooling and test equipment information
- i. Initiates changes to spare parts information
- j. Initiates spares provisioning action
- k. Initiates instruction book and handbook changes
- l. Becomes part of the historical record of the project
- m. Initiates a "hold order" to stop production and a "hold release" to subsequently release it



Changes may be authorized only by or with the approval of the Program Manager for the Lunar TV Camera. Configuration management is the responsibility of the Program Manager. All changes to the camera must be approved by the Configuration Control Board (CCB). The CCB will, as a minimum, consist of representatives of Project Engineering, Manufacturing, and Product Reliability in addition to the Program Manager. Product Reliability signs off all Revision Notices. Configuration changes are processed and approved by the CCB according to the Revision Notice Procedure.

Configuration identification is defined by customer specifications, engineering drawings, and other supporting specifications. Project Engineering prepares and distributes the approved Revision Notices to Product Reliability, Manufacturing, and Purchasing after completion of the CCB meeting. Manufacturing is responsible for maintaining configuration of all in-house fabricated items; Purchasing furnishes revision information to suppliers of affected items; and, Product Reliability is responsible for verifying the configuration of all items at receiving inspection, assembly, test, and shipping. Product Reliability prepares and maintains up-to-date configuration control data books for the Lunar TV Camera Program. A configuration control flow diagram for the Lunar TV Camera Program is shown in Figure 2-2.



1955A-VB-13

Figure 2-2. Lunar Camera Configuration Control



Changes to inspection and/or test station instructions and procedures unique to the Camera Program are the responsibility of Product Reliability and are reviewed and approved by the Product Reliability Director prior to release. Copies of all applicable station instructions and procedures are placed at inspection stations, and controlled distribution maintained. A master file is maintained in the Product Reliability Program office.

2.3.2 Effectivity

The break-in point for all changes is specified on the Revision Notice. The break-in point is determined by Engineering, Manufacturing, and Technical and Logistic Support. Product Reliability is responsible for inspecting and verifying hardware conformance to the configuration specified at all levels of inspection, test, and final verification against the configuration control list and contract requirements.



SECTION 3

MANAGEMENT

3.1 PLANNING

The Westinghouse approach to the quality program for the Lunar TV Camera includes the following:

3.1.1 Clearly Specified Policies and Objectives

The management policies in the Aerospace Division regarding reliability and quality assurance functions are defined in the Reliability and Quality Assurance Policy Manual. This manual was prepared by the Product Reliability and Engineering Departments. The Product Reliability Department is responsible for publishing, maintaining, and distributing the manual and for coordinating all revisions. The policy statements in this manual provide direction for all Aerospace Division departments and delineates responsibilities for reliability and quality assurance.

The objective of quality assurance is to provide the controls necessary to convert a design into equipment while maintaining the designed reliability. The quality assurance system meets the provisions of MIL-Q-9858A and with additional implementation as detailed in this document, complies with NASA NPC-200-2.



3.1.2 Documented Means for Measuring the Effectiveness of the Quality Plan

Inspection and test records provide documented information for measuring the adequacy of the quality plan. Evaluation of this data provides guidelines for implementing the necessary changes or additions required, to correct deficiencies that may exist in the application of the quality plan to the fabrication, assembly, and test of the television camera. Timely corrective action is taken in those areas where quality problems may appear.

3.1.3 Quality Program Plan Submission

The quality program plan herein is submitted for NASA-MSD approval. Changes or additions written to the quality program plan after approval has been given are submitted three weeks prior to their implementation.

3.2 ORGANIZATION

The Product Reliability Department of the Aerospace Division has the organization and authority to maintain control of production operations and related division efforts affecting quality. The Manager of Product Reliability reports to the Aerospace Division General Manager and is responsible for overall quality assurance. The Director of Product Reliability for the Lunar TV Camera is responsible for implementing the quality plan. He reports directly to the Lunar TV Camera Program Manager for technical direction and receives administrative policy direction from the Manager of Product Reliability.



Figure 3-1 shows the relationship and function of the Director of Product Reliability to the Lunar TV Camera program organization.

3.3 WESTINGHOUSE AEROSPACE DEPARTMENTAL RESPONSIBILITIES

Westinghouse Aerospace recognizes that compliance to the provisions of NPC-200-2 encompasses areas other than quality assurance. The attached matrix (Figure 3-2) outlines the department responsibilities for each section of NPC-200-2 and indicates the overlapping functions required to implement these requirements. Where one element appears as the responsibility of several departments, specific details to each section's function have been included in the quality plan. The relationship of the basic provisions to the Reliability and Quality Assurance Policy Manual is also listed on the matrix.

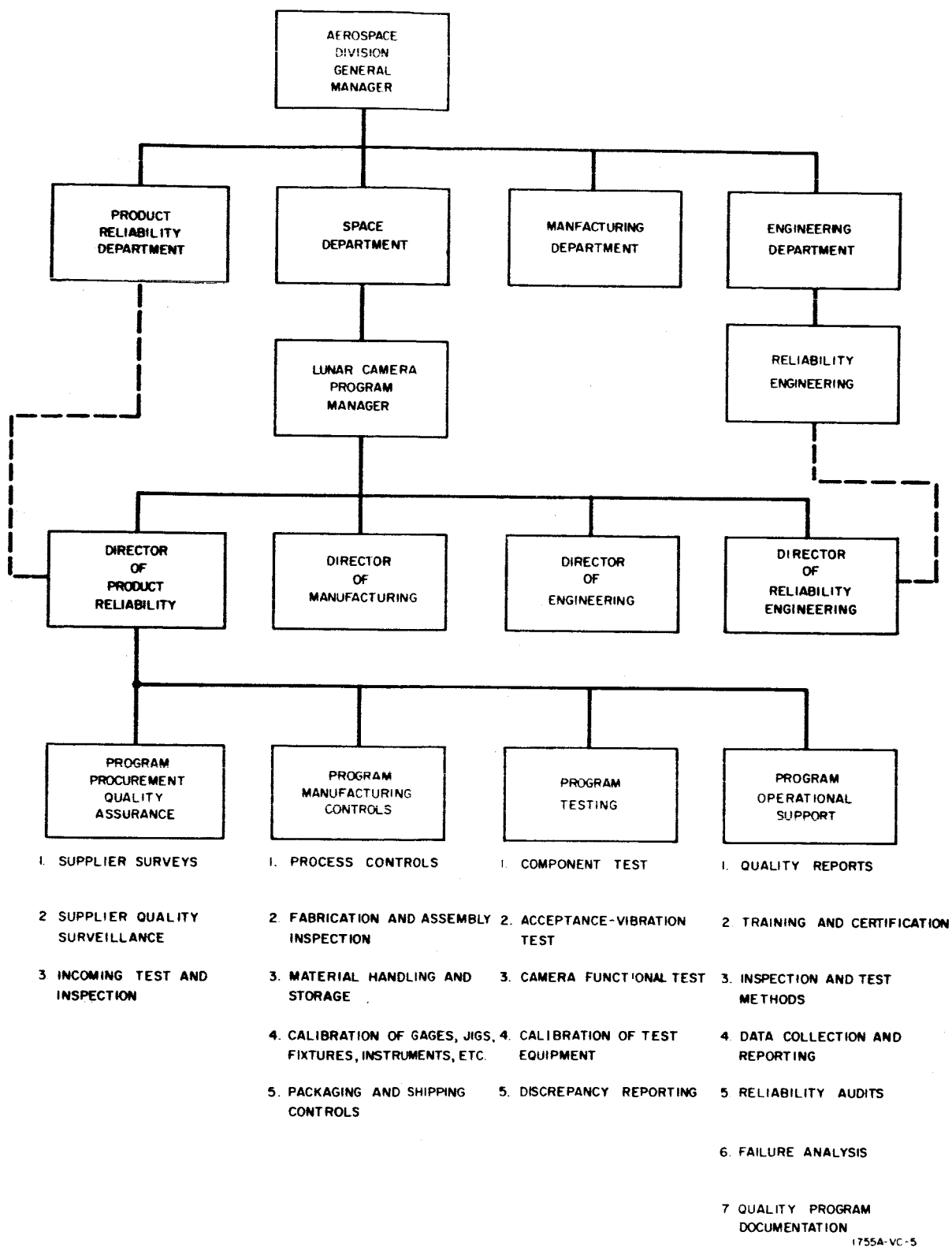


Figure 3-1. Quality Assurance Organization



ELEMENTS	ENGR			REL			Q.C.			MFG			PURCHASING			WEC SYSTEM
	I	M	A	I	M	A	I	M	A	I	M	A	I	M	A	
BASIC REQTS.																R AND QA MANUAL
2.1 GENERAL							X		X							1.1, 1.2
2.2 DOCUMENTATION	X						X		X							1.1, 1.2
2.3 CHANGE CONTROL	X						X		X	X			X			2.15
MANAGEMENT																
3.1 PLANNING							X		X	X						1.1, 2.2, 3.19
3.2 ORGANIZATION							N/A									1.2
DESIGN AND DEV. CONTROL																
4.1 GENERAL	X						X	X		X						2.5, 2.6
4.2 DWG AND SPEC REVIEW	X						X	X	X	X						2.7, 2.9
4.3 QUAL TESTS	X						X									2.8
4.4 IDENTIFICATION	X								X							2.10, 2.15
CONTROL OF PROCURED MATL																
5.1 GENERAL	X						X	X	X				X			2.4, 2.16
5.2 SELECT. OF SOURCES	X						X		X				X			2.16
5.3 PROCURE DOCUMENTS	X						X		X				X			2.16
5.4 GOVT SOURCE INSP							N/A									2.16, 2.20
5.5 CONTRACTOR SOURCE INSP	X						X	X	X							2.16
5.6 REC. INSP	X						X	X	X				X			2.16
5.7 IDENTIFICATION							X	X	X	X						2.10, 2.16
5.8 FAILURE AND DEF. FEEDBACK	X	X	X				X	X	X				X			2.15
5.9 SUPPLIER RATING	X						X		X				X			2.16
5.10 SUPPLIER MEAS EQPT	X						X		X				X			2.16
GOVT FURNISHED PROPERTY																
6.1 INSPECTION	X						X		X							2.20
6.2 DEFECTIVE	X						X	X	X							2.20
CONTROL OF FAB. ART.																
7.1 GENERAL	X						X	X	X	X			X			2.10
7.2 CONFORM CRITERIA	X						X		X							2.10
7.3 INSP. AND TEST PLAN	X						X	X	X				X			2.10
7.4 INSP. AND TEST PERF.	X						X	X	X	X						2.10
7.5 FABRICATION CONTROL	X						X	X	X	X						2.10
NON CONFORMANCE MATL																
8.1 MATL REVIEW	X						X	X	X	X			X			2.14
8.2 APPROVAL OF CONTRACT OFFICER							X		X							2.14
8.3 CONTROL OF NON CONF MATL							X	X	X							2.14
8.4 REWORK w/o MRS							X		X	X						2.14
INSP. AND T.E.																
9.1 GENERAL	X						X	X	X	X						2.12
9.2 CALIBRATION							X	X	X							2.12
9.3 FAC. AND STDS							X	X	X							2.12
9.4 EVALUATION	X	X					X		X							2.12
9.5 MAINT. AND CONTROL	X	X					X	X	X							2.12
9.6 WRITTEN PROCED	X	X	X				X	X	X							2.12
9.7 RECORDS	X						X	X	X							2.12
INSP. STAMPS																
10.1 GENERAL							X	X	X							2.18
PRES., PACK, HAND																
11.1 GENERAL	X						X	X	X	X						2.17
11.2 PRESERVATION	X						X	X	X	X						2.17
11.3 PACKAGING	X						X	X	X	X						2.17
11.4 HANDLING							X	X	X	X						2.17
11.5 STORAGE							X	X	X	X						2.17
11.6 SHIPPING							X	X	X	X						2.17
STATISTICAL PLAN.																
12.1 GENERAL							X	X	X							2.19
12.2 STATIS. AND TEST PLAN							X	X	X							2.19
12.3 SAMPLE PLANS							X	X	X							2.19
12.4 STATIS. CHARTS							X	X	X							2.19
TRAIN AND CERT OF PERS.																
13.1 TRAINING	X						X	X	X	X						2.4
13.2 CERTIF. OF PROCESS AND PERS.							X	X	X	X			X			2.11
DATA REPORT AND CORR. ACTION																
14.1 GENERAL							X	X	X							2.14, 2.18
14.2 DATA REPORT							X	X								2.18
14.3 CORR. ACTION	X						X		X	X			X			2.14
AUDIT																
15.1 PERFORMANCE							X	X	X							2.10
15.2 AUDIT REPORTS							X	X								2.10

1955A-VC-12-1

Figure 3-2. Westinghouse Departmental Responsibilities for Compliance to NASA NPC 200-2

SECTION 4

DESIGN AND DEVELOPMENT CONTROL

4.1 GENERAL

Westinghouse Aerospace has a program to establish and document quality and reliability criteria during the preliminary design and development stages, and maintain it throughout the contract.

4.2 DRAWING AND SPECIFICATION REVIEW

4.2.1 Design Review

Prior to release design review of drawings, specifications, and technical documents are performed as outlined in paragraph 3.6 of the Reliability Plan. Product Reliability participates in the design reviews. Of primary concern are those items which determine or control the quality of purchased and Westinghouse produced articles, such as: identification, critical quality characteristics, test and inspection methods, and quality requirements.

4.2.2 Qualified and Preferred Parts

The design reviews ensure that the designs make full utilization of preferred parts which meet the performance, quality, and reliability requirements of the contract. Preferred parts and material selection is described in paragraph 3.9 of the Reliability Plan.



4.2.3 Government Document Review

Government documents specified in the camera specification are implemented by Westinghouse. Addenda and supplements to adequately define the quality requirements of the fabricated articles are provided as necessary in the form of drawings, procedures, process specifications, or station instructions.

4.3 QUALIFICATION TESTS

4.3.1 General

Qualification tests of materials, processes, parts, components, subassemblies, and the final camera assembly are performed to demonstrate that the design is inherently capable of meeting the contractual requirements. In-plant qualification tests are accomplished in accordance with written test procedures prepared by the Aerospace Test Laboratory under the direction of Project Design and Reliability Engineering. The qualification test plan is outlined in the Integrated Test Plan prepared by Reliability Engineering. Product Reliability audits qualification tests.

These audits consist of the following:

- a. Checking test equipment calibration status and condition
- b. Review equipment log documentation for adequacy of engineering entries.
- c. Review discrepancy report forms for completeness and corrective action progress.



- d. Audit engineering use of current test specifications and drawings.
- e. Check adequacy of camera handling and preservation during qualification testing.
- f. Perform and document mechanical and visual inspections of the camera or subassemblies after exposure to certain environments.
- g. Surveillance of entire qualification test program status.

Qualification test procedures, results, status, and discrepancy data are submitted to NASA or designated representative for review.

4.3.2 Parts, Components, and Subassemblies

Procurement sources submit qualification test data to Westinghouse for parts, components, and subassemblies as required by the procurement document. This data is reviewed by Project Design and Reliability Engineering to determine if additional testing is needed to fulfill reliability requirements. Finished parts fabricated in-plant such as modules, board assemblies, structure, etc., are qualified in the completed camera assembly qualification tests.

4.3.3 Systems and Major Subsystems

Qualification tests of the completed camera assembly is conducted on three prototype models as outlined in the Integrated Test Plan referenced above. Upon completion of designated test series, the camera is packaged and moved to the clean room for



a complete visual and mechanical inspection by Product Reliability. All inspection and discrepancy data is recorded and included in the qualification test report.

4.3.4 Requalification Tests

Qualification tests are repeated when inspection, tests, or operational data indicates the inadequacy of a qualified article, or as contract requirements direct. Reliability Engineering analyzes all design changes to determine requalification requirements.

4.3.5 Qualification Status List

Reliability Engineering maintains a qualification status list documenting all purchased and in-house items that have been qualified and those requiring qualification. The status list is in accordance with the NASA-MSC requested format. This data is updated and submitted monthly to NASA for review.

4.4 IDENTIFICATION

Materials, processes, and design parameters are so identified in the design documentation that the engineering features to be evaluated may be associated with the particular articles. Each article, unless physically impractical, is identified by a unique part number and serial number that is consistent with the engineering drawing and change control system.



Those items not physically serialized are assigned lot number identity.

In all cases, the manufacturing records can trace an item from the part level to system level (up and down).

SECTION 5

CONTROL OF CONTRACTOR PROCURED MATERIAL

5.1 GENERAL

Westinghouse Aerospace assumes the responsibility for the adequacy and quality of materials, articles, and services procured for this program. Westinghouse responsibility includes:

- a. Selection of qualified procurement sources
- b. Transmittal to the supplier of the design, reliability, and quality requirements
- c. Receiving inspection of the procured items
- d. Feedback and corrective action systems
- e. Providing technical assistance and training to suppliers, when necessary, to improve reliability and quality levels.
- f. Failure analysis

5.2 SELECTION OF PROCUREMENT SOURCES

5.2.1 General

A vendor survey team comprised of personnel representing Purchasing, Reliability Engineering, Engineering, and Product Reliability visit major suppliers of Lunar TV Camera parts to survey their facilities for compliance with quality and reliability requirements. If the supplier of part has a previous and continuous quality record on articles of the same type purchased for the camera, a survey is not made.



Documented evidence of the supplier's quality and reliability program is required. Surveys may be conducted on both a pre-award and postaward basis. Suppliers are resurveyed when conditions arise that may invalidate a previous survey such as deficiencies in materials received. Documented survey reports are available to NASA or its designated representative upon request.

5.2.2. Records

Product Reliability maintains the records necessary for establishing and maintaining a quality history for each subcontractor and supplier in accordance with the Westinghouse Aerospace supplier evaluation and rating procedure.

5.3 PROCUREMENT DOCUMENTS

5.3.1 Contents

Subcontracts and purchase orders include provisions for the following as applicable:

- a. All drawings, specifications, reliability and quality requirements, test and inspection procedures, latest revision letter, and special inspection and test equipment, as applicable, is referenced and made available as necessary to NASA or its designated representative for review.



- b. The following provision is included: "the Government reserves the right to inspect any or all of the work at the supplier's plant".
- c. Westinghouse Aerospace source inspection and test requirements.
- d. Subcontractor quality programs are classed in one of the following categories:
 - (1) The requirement to establish and maintain a quality system which meets the intent of NPC-200-2. (The supplier of the SEC Vidicon tube is in this category.)
 - (2) The requirement for suppliers of materials, parts, and components to conform to portions of NPC-200-3 as selected and specified by Westinghouse in the purchasing specifications. (Suppliers of diodes, resistors, capacitors, transistors, and hardware are in this category.)
 - (3) Other subcontractors having design responsibility of producing complex subassemblies are required to follow certain applicable portions of NPC-200-2 and all the provisions of NPC-200-3 as specified by Westinghouse purchasing specifications. (Suppliers of the yoke, integrated circuits, and optics are in this category.)

All supplier quality programs and inspection systems are subject to survey by the cognizant NASA installation, its authorized representative and/or Westinghouse Aerospace.



- e. Chemical and physical test documentation for those raw materials designated as critical by the Westinghouse Lunar TV Camera Project.
- f. Requirements for chemical analysis, physical tests, and lot identification records of raw material procured by the supplier to fabricate parts for Lunar TV use. These records are available to Westinghouse Aerospace Product Reliability upon request.
- g. The submittal of documented evidence of acceptance and qualification tests and verification of Westinghouse and/or Government source inspection, when delivery is made to Westinghouse Aerospace.
- h. Necessary requirements for identification, special preservation, and packaging to preserve the quality of procured articles.
- i. The manufacture date and the date when useful life is expended for items having definite characteristics of quality degradation or drift with age or use.
- j. All supplier articles rejected and subsequently resubmitted by the supplier is identified as being resubmitted by the supplier either on the articles or on the shipping documents. The supplier must reference the Westinghouse Aerospace rejection document (MRN) and supply information as to his corrective action taken.



- k. Suppliers are required to obtain Westinghouse Aerospace Project approval, in writing, of any design, fabrication, or process change after the product has been supplied to the design requirements.

5.3.2 Review

Prior to release, all procurement documents are reviewed by Product Reliability to assure compliance with the requirements established in paragraphs 5.2 and 5.3 of this program plan. All procurement documents are available at Aerospace for review and information to the NASA representative.

5.4 GOVERNMENT SOURCE INSPECTION

If the need for government source inspection is determined by NASA-MSC or its designated representative, the purchase orders contain the statement of NPC-200-2, Section 5, paragraph 5.3.1b. Contractor source inspection is performed as defined in paragraph 5.5.

5.5 CONTRACTOR SOURCE INSPECTION

Westinghouse Product Reliability utilizes source inspection or requires objective evidence that the supplier complies, in detail, with applicable requirements if the following exists:

- a. The articles are at a level of assembly that precludes adequate inspection at Westinghouse Aerospace.
- b. In-process controls have such an effect on the quality and reliability of the article that quality cannot be determined



by test and inspection on completed articles.

- c. Verification tests at Westinghouse are destructive in nature.
- d. Special test equipment required would be too costly to duplicate.

Westinghouse Field Quality Control personnel monitor the supplier's manufacturing, inspection, and test procedures for compliance to the quality requirements of the contract. A Field Quality Control Representative is resident at Elmira, New York, to monitor the camera tube manufacture and witness acceptance tests.

5.6 RECEIVING INSPECTION

The packaging requirements are specified in the procurement specifications. Double shipping containers, except for raw material, are required of all vendors for the camera. Each container is identically marked. A packing slip is attached to the outside of the exterior shipping container in a weatherproof envelope in a manner such that the container does not have to be opened to gain access to the packing slip. A duplicate packing slip is enclosed within the interior shipping container. Test and inspection records of the article are also enclosed within the inner container. Upon receipt of the article at Westinghouse Aerospace, the receiving department removes the external packing slip, stamps the package, assigns the inspection lot control number on the inspection cards and forwards the inner carton to the receiving inspection area of the Lunar TV Camera clean room for inspection and/or functional tests.



Articles are not accepted unless:

- a. they have been qualified and appear on the qualification status list
- b. they are designated for qualification in another assembly
- c. the omission of qualification tests has been justified on the qualification status list and approved by NASA-NEC
- d. satisfactory evidence of adequate inspection and tests having been performed by the supplier in accordance with the purchase order.

Upon receipt, electrical and/or mechanical tests are performed on all articles which have not been source witnessed by Westinghouse Aerospace Product Reliability personnel. Visual and mechanical inspection is performed on all items regardless of source coverage. Inspections are performed in accordance with the latest officially released drawings, specifications, station instructions, and procedures. Receiving inspection is equipped with the necessary inspection and test equipment, drawings, specifications, catalogs, etc., to perform its operation upon receipt of the item. Detailed inspection and test procedures are written for all critical items to assure that only top quality items are accepted from the suppliers. Items having shelf life characteristics are inspected to assure that the manufacturer's expiration date is indicated. Raw material received is chemically and physically tested on a random basis



per Material Inspection Detail cards prepared by Product Reliability. Receiving inspection physically separates Lunar TV raw materials and fabricated articles from other contract materials. Separation as a minimum shall consist of:

- a. Materials awaiting inspection or test results
- b. Conforming materials or articles
- c. Rejected materials or articles

5.7

IDENTIFICATION

Identification of hardware is maintained as follows:

- a. All subassemblies are serialized by the supplier.
- b. All electronic components which require burn-in and variable data recording are serialized where physically practical. Those not physically serialized retain their identity by the assigned lot number.
- c. All raw material purchased specifically for this program is controlled by purchased lot identification established at receiving and related to the purchase order number.
- d. All material accepted or rejected at receiving inspection is identified as to its status by an inspection stamp placed upon the accompanying documentation. Use of the stamp is described in Section 10 of this quality plan.



5.8 FAILURE AND DEFICIENCY FEEDBACK

The Material Rejection Notice (MRN) (Figure 14-1) is utilized to document all rejected material when received. The Discrepancy Report Form PA-5144E (Figure 14-3) documents failure of purchased material at the test level. Letters of complaint and corrective action requested are written to the supplier as part of the Westinghouse feedback system. Detailed information on Westinghouse failure reporting and corrective action is found in Section 14 of this quality plan.

5.9 SUPPLIER RATING AND PREFERRED SOURCE LISTS

The Westinghouse Aerospace Division utilizes a computer tabulated Vendor Quality and Procurement Cost Control system as an input to preferred source determinations and to assign corrective action priorities. The system compiles a history of individual vendor discrepancy data and costs incurred for processing nonconforming material. This information is used by Engineering, Purchasing, and Product Reliability to monitor vendor quality trends and to initiate timely corrective action. The Vendor Quality Rating and Procurement Cost Control Report is issued monthly and provides the following data for each vendor by part number:

- a. Vendor identification
- b. A Lot Quality Rating (LQR) for the reporting month

$$LQR = 1 - \frac{\text{Quantity Rejected}}{\text{Quantity Inspected or tested}} \times 100$$



- c. The cost of processing nonconforming material for the reporting month
- d. An LQR for each of the 6 preceding months
- e. An average LQR for the past 6 months performance
- f. A 6 months summary of rejection costs incurred

The Procurement Quality Assurance Section of Product Reliability evaluates the report continuously to determine corrective action attention and effort priorities. Corrective action is initiated and coordinated through Engineering, Purchasing, and the vendor for problem investigation and resolution.

5.10 COORDINATION OF CONTRACTOR-SUPPLIER MEASURING AND TEST EQUIPMENT AND STANDARDS

Westinghouse assures that the suppliers utilize a calibration system that is traceable to the National Bureau of Standards and provides control of, and periodic calibration of, all measuring equipment used to verify engineering parameters of articles submitted. If identical special equipments are used at Westinghouse and the suppliers facilities, periodic correlation checks will be made. Inspection procedures and workmanship standards are correlated between Westinghouse inspection and the supplier.



SECTION 6

GOVERNMENT FURNISHED PROPERTY

Westinghouse complies with NASA regulations in controlling the government furnished property to be supplied the contractor in performance of the Lunar TV program. Reference NASA Procurement Regulations Part 13 entitled "Government Property" and ASPR Section 13 and Appendix B.

In compliance with the above referenced Regulations, Westinghouse has prepared a detailed procedure for the control of government property. This procedure entitled "Westinghouse Electric Corporation Baltimore Divisions Manual For Control of Government Property" has been approved by the Local Cognizant Inspection offices (BuWeps Rep. Balto.) and Balto. District office, Defense Control Administration Services Region, Westinghouse Electric Corp. Defense and Space Center, Baltimore, Maryland. This procedure covers the receipt, incoming inspection, storage, identification, issuing and disposal of government property which has been acquired for the account of the government or is furnished by the Government for use in performance of the contract.

Highlights of this contractor's "Manual for Control of Government Property" are as follows:

1. Receipt of Government Furnished Property is recorded on standard Westinghouse Form 30666 Request for Government Property.



2. Incoming inspection is performed by visual means to determine quantity of containers shipped are the actual quantity received, and that there is no visual damage caused in transit.
3. Recording & storage of government property is maintained in a segregated storeroom (separate from contractor property). Identification and marking of the property is made in the Government Property Storeroom.
4. Issues from Government Storeroom of properties are made on an approved issue document. Electrical performance is verified on those items requiring same.
5. Upon completion of a contract all residual inventory is moved to the Government Warehouse Storage area. This residual property is held until authority for its removal is received from the government.

Copies of the complete procedure for the Control of Government Property are available for NASA MSC review upon request.

When GFE items are moved from Westinghouse to GSFC or another government facility for major environmental tests, the items are moved on a Government shipping document (DD1148 or DD1149). If the items are to be delivered as a contract-end-item, then all shipments are made on a DD250.



SECTION 7

CONTROL OF CONTRACTOR-FABRICATED ARTICLES

7.1 GENERAL

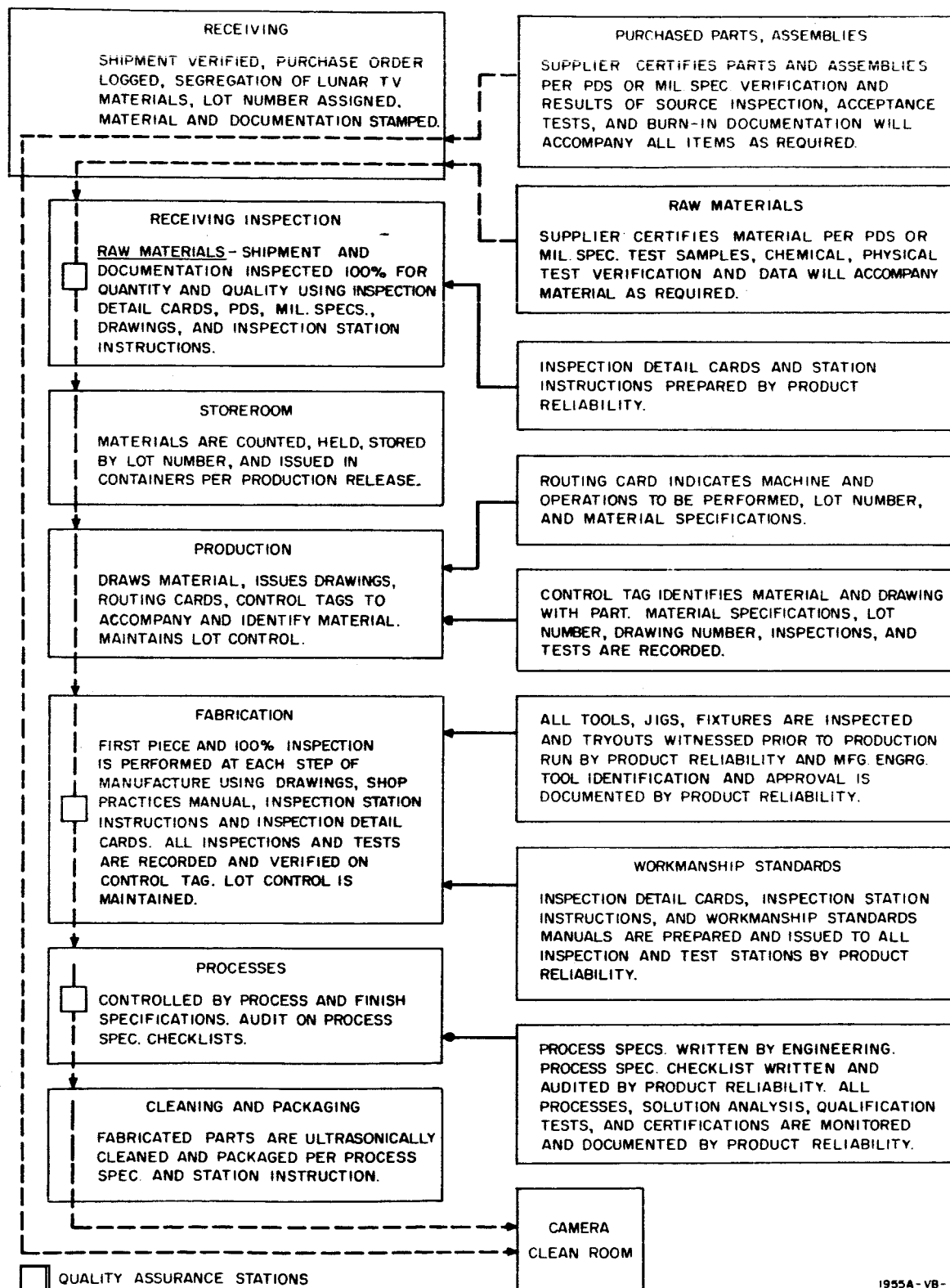
The quality control system at Westinghouse Aerospace assures that adequate control of quality is maintained throughout the receipt, identification, stocking, and issue of material, and the entire process of development, manufacture, packaging, shipping, storage, and maintenance. All articles fabricated are subject to control at such points as necessary to assure conformance to drawing and specification requirements. Inspection and test procedures (implemented by Product Reliability) are prepared and maintained to supplement the applicable engineering drawings and specifications, and make clear the manner in which such procedures are used. A Material Flow Chart for the Lunar TV Camera is shown in Figures 7-1 and 7-2.

7.2 CONFORMANCE CRITERIA

The basic documents that govern conformance of fabricated articles to the contract requirements and establish acceptance and rejection criteria are the Reliability and Quality Assurance Policy Manual, Process Specifications, Drawings, Workmanship Standards, and Product Reliability Inspection and Test Station Instructions.

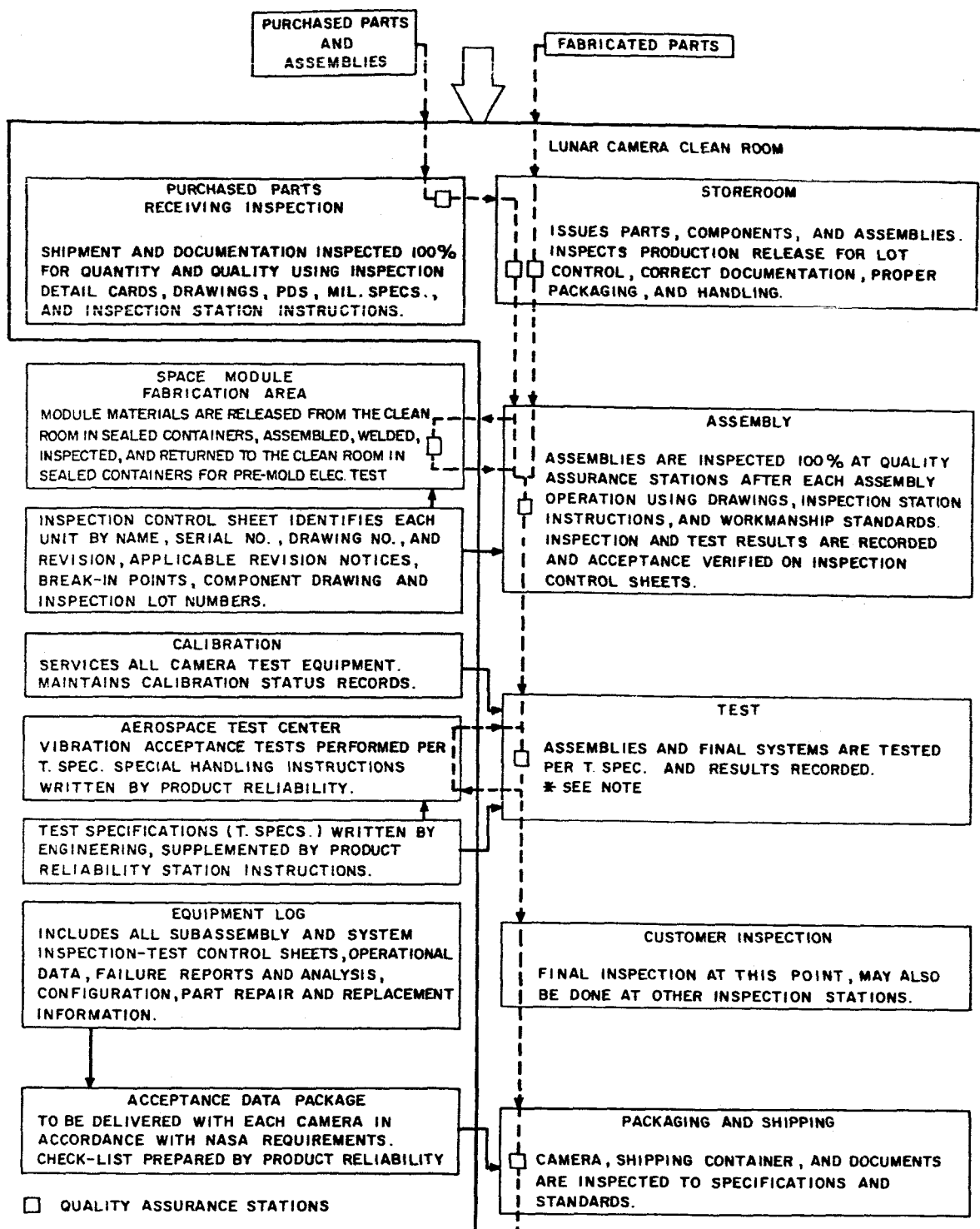
7.3 INSPECTION AND TEST PLANNING

Upon completion of the camera design, representatives of Design



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Figure 7-1. Material Flow Chart (Incoming)



NOTE: A DETAILED END-ITEM TEST AND INSPECTION DIAGRAM SHOWING INDIVIDUAL UNIT ASSEMBLY INSPECTION, AND TEST SEQUENCE WILL BE SUBMITTED WITH THE END-ITEM TEST PLAN AT A LATER DATE.

1955A-VB-17

Figure 7-2. Material Flow Chart (Test and Assembly)



and Reliability Engineering, Product Reliability, and Manufacturing participate in comprehensive studies of the camera mechanization, electronic packaging, and material integration. Results of these studies are used to establish an effective sequence of in-process fabrication, assembly, inspection, and test operations that assures compliance with the quality and reliability requirements. Planning also includes provisions for customer inspection at different levels of in-process assembly.

Advance planning is made for the end-item test plan described in paragraph 7.4.2. After the level of testing has been established by Engineering and Product Reliability, test tooling requirements are planned in conjunction with the Product Support Equipment Department. A review of the assembly drawings is conducted to determine the need for any special tools to check drawing dimensions.

7.3.1 Inspection and Test Procedures

Specific inspection procedures are written by Product Reliability Engineering for:

- a. Subassemblies that require special detailed instructions to assure product compliance with requirements.
- b. Major assemblies
- c. Items that require critical mating dimensions for proper functional operations.



These inspection procedures include acceptable workmanship standards as established by Product Reliability.

Engineering prepares and releases test requirement specifications for testing of individual parts, subassemblies, and major assemblies. Information supplied by Engineering to the test equipment design group is integrated with the test tool design requirements to become the operational test specification. The above inspection and test specifications include the following:

- a. Article identification
- b. Objectives of the test
- c. Special measuring and test equipment to be used specifying instrument to be observed
- d. Detailed operations to be performed by the test operator
- e. Special environmental and/or input conditions that must be maintained during test
- f. Test parameters including tolerances, to be measured and recorded
- g. Criteria for determining conformance or rejection

All test specifications and inspection procedures are kept at the inspection or test station and are readily available for use by the inspector or tester. Test specifications are supplemented by station instructions specifically detailing the use of special documents, log recording, data handling, failure reporting, customer submittal, etc.



7.3.2 Establishment of Values to be Observed

Those characteristics which are to be observed during test and inspection are defined by Engineering in terms of performance data and given tolerances for determination of acceptability.

7.3.3 Workmanship Inspection Standards

Where necessary, standards (models) are selected as examples of acceptable workmanship. The standard (a component, a sub-assembly, or the completed assembly) is jointly selected by Product Reliability and NASA, or its designated representative. The standard is kept updated to the latest configuration and assembly techniques. Written workmanship standards are part of the inspection procedures described in paragraph 7.3.1.

7.4 INSPECTION AND TEST PERFORMANCE

Product Reliability performs inspections and tests as described in the previous paragraphs and indicates conformance through quality control documentation. Inspection control sheets (Figures 7-3a and 7-3b) are used to document inspections and tests starting at the module level. Documentation of inspections and tests prior to module level are described in para. 7.5.2. The control sheet identifies the unit by name, drawing number, and revision, serial number, shop order, applicable revision notices, break-in points, component drawing numbers, and component inspection lot numbers. As each operation is completed it is signed by the assembly operator, inspected, and if acceptable stamped by the inspector. Any discrepancies found during



LUNAR
INSPECTION CONTROL SHEET

[illegible]

OPERATIONS

OPER	DESCRIPTION	OPERATOR	DATE	OPER	DESCRIPTION	OPERATOR	DATE

COMPONENTS

[illegible]

INSPECTION/TEST APPROVALS

[illegible]

P. R. FORM NO. 301

Figure 7-3a. Lunar TV Inspection Control Sheet

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LUNAR TV INSPECTION AND TEST LOG

[illegible]

Figure 7-3b. Lunar TV Inspection and Test Log

[illegible]

Figure 7-3c. Lunar TV Camera - System and Component Log

1955A-VB-14A



inspection and test are recorded on the inspection control sheet, and re-inspection is performed after any rework operations before inspection stamp-off. Stamp traceability is described in Section 10.

Electrical characteristics are determined by testing to engineering test specifications. All discrepancies, malfunctions, adjustments, out of tolerance conditions, etc., are recorded on the Discrepancy Report (Form BA 5144). Inspection personnel are responsible for determining whether the unit and/or assembly is built to the correct configuration and is in conformance with drawing and specification requirements. Nonconforming articles that require formal MRB action are processed as described in Section 8.

The format and procedure for use of the equipment log (Ref. NPC 250-1 Section 3.10) to be employed on the Lunar TV Camera program is the responsibility of the Product Reliability Department and is described herein. See Figure 7-3c for proposed format.

Each system equipment log package includes the inspection control sheets described previously in this section. The log (including inspection and control sheets) lists all parts required to assemble the camera and documents the following:

- a. lot identification
- b. serial number
- c. operating time and/or shelf life



- d. idle periods (defined as any period of time that the camera is nonoperating)
- e. date of test operation
- f. type of tests performed and their environment
- g. failure reports
- h. repairs and replacements
- i. configuration of test equipment and calibration due date
- j. accumulated numbers of duty cycles
- k. record of questionable occurrence
- l. test data sheets
- m. identity of tester
- n. design changes originating from test evaluations (originating on a Request for Engineering Action Report (Figure 7-4)).

In addition, a configuration list is provided listing all applicable drawings and revisions, and serial number of any replaceable parts installed.

Product Reliability initiates the equipment log prior to the start of system camera acceptance test. Technicians and inspectors record the required data. All subassembly inspection control sheets are attached and become an integral part of the equipment log. Any replacements of subassemblies during acceptance testing are documented on the equipment log and the inspection control sheets are changed accordingly. The log applies to all cameras except Service Test Model No. 1 built on this contract, including the periods of



FURNISHED BY: WESTINGHOUSE PRINTING DIVISION, TRAFFORD, PA.

REQUEST FOR ENGINEERING ACTION
Form 3009BA

No. 29998

TO Manfg. Engr. _____ Dept. _____ Mail Stop _____
 Test Engineer _____ Dept. _____ Mail Stop _____
 Engineer _____ Dept. _____ Mail Stop _____
 We are experiencing difficulty in the performance of _____
 (DRAWING, B. GROUP OR ITEM)
 for use with _____ of _____ as follows:
 (UNIT OR SYSTEM) (EQUIPMENT)

Model _____		Production Order No. _____	
Equipment applicable on Order No. _____			
This requires attention <input type="checkbox"/> Immediately <input type="checkbox"/> Early as Convenient <input type="checkbox"/> Within _____ hours			
Requested By _____	Title _____ Dept. _____	Date _____ Time _____	Mail Stop _____ Phone _____
Additional Data Added By _____	Title & Dept. _____	Date & Time _____	Mail Stop _____ Phone _____
C. O. No. _____			
Action Taken: C. N. No. _____			

Apply to Serial Nos. _____ Order Nos. _____

Corrected By _____ Dept. _____ Date _____ Phone _____ Mail Stop _____

RETURN TO ORIGINATOR

Figure 7-4. Request for Engineering Action

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qualification testing, of which Product Reliability will audit. Two copies of the equipment log becomes a part of the acceptance data package to be sent with each camera shipped.

7.4.1 In-Process Inspection

Inspections and tests are performed at each step where the ability to inspect or test might be impaired or deficiencies concealed by a further operation.

Fabrication operations are detailed in Routing Cards (Figure 7-5) prepared by Manufacturing and include the operation description and number, responsible section performing the operation, tool requirements, machine utilization, quality requirements such as inspection and test points, and process specifications. Prior to release, all routing cards are reviewed by Product Reliability to determine if the points of inspection, types of inspection, tests and other quality provisions have been incorporated.

Typical in-process control inspections that are performed during the fabrication of the welded modules for the camera are shown in the flow diagram in Figure 7-6.

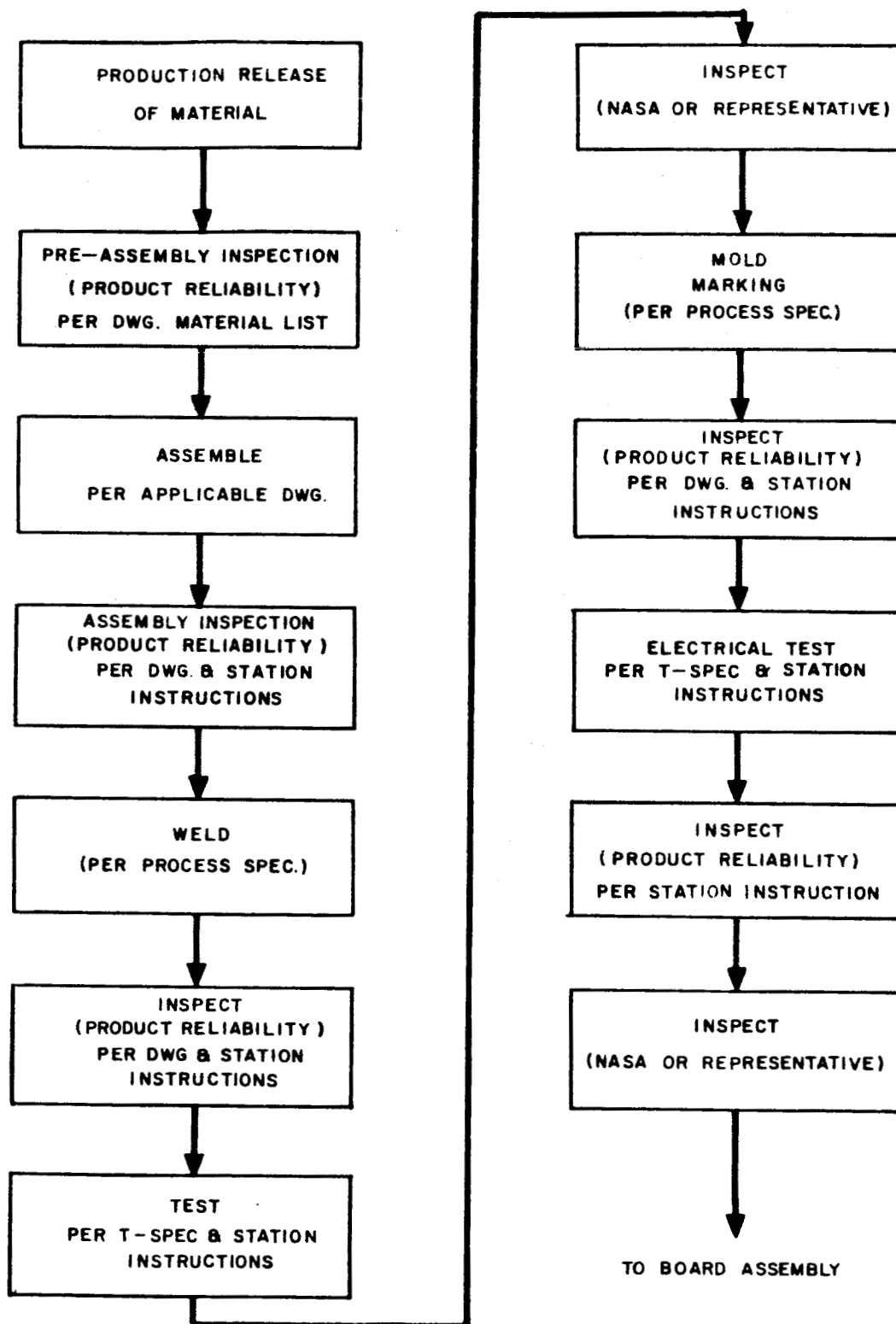
7.4.2 End-Item Tests and Final Inspection

7.4.2.1 End-Item Test Plan

A detailed End-Item Test Plan will be submitted to NASA-MSC for review prior to beginning test on Service Test Model #2.

[illegible]

Figure 7-5. Routing Card



1955A-VB-15

Figure 7-6. Module Construction Flow Chart



The End-Item Test Plan includes a technical description of the camera and all its subassemblies, parameters to be inspected and tested on each subassembly or completed camera. Nominal tolerances of these parameters and the sequence of tests are also included. Product Reliability prepares this plan from information obtained in the test requirements prepared by Engineering.

7.4.2.2 Tests and Inspections

A detailed inspection is made on each subassembly and completed camera prior to testing. The assemblies are inspected to the latest applicable drawing, specification, or inspection procedure. Each article is inspected for conformance to drawing or specification, possible damaged components, potential short circuits, and overall workmanship. A circuit check is made on those assemblies where inter-connecting wiring has been made. Acceptance tests are performed on modules, boards, camera semicomposite and composite. Composite test of the camera is performed in such a manner and under conditions that simulate end use to the highest degree practicable without damage to the camera. Tests are conducted in a darkroom under simulated light conditions with various size targets and at different temperature controlled light intensities. These tests include resolution, linearity, gray scale, sensitivity, video bandwidth, and aspect ratio. The test specifications are supplemented by test and inspection procedures which are submitted for NASA MSC review prior to beginning end-item testing.



Random vibration is performed on the camera as part of the acceptance tests. Demonstration is made to the NASA-MSC representative during tests prior to vibration, during vibration, and post vibration tests.

Any unusual occurrence or questionable condition observed during these tests whose detection or correction may not be a contractual requirement is reported to the NASA-MSC representative so that the necessary action and/or contract change may be initiated.

7.4.2.3 Documents and Records

Data on the final test of the end-item is submitted with the equipment log (which is part of the acceptance data package) for each camera as part of the shipping documentation.

7.4.2.4 Modifications After Final Tests and Inspections

After completion of final tests and inspections, any modifications, repair or parts replacement will require that the camera be subjected to retest and reinspection by Westinghouse and the NASA representative. These tests will prove compatibility with associated subassemblies.

7.4.2.5 Personnel

All inspection and test personnel are members of the Product Reliability Department. Test and inspection personnel are of high technical ability and have had previous experience on complex airborne or space subsystems. These personnel are given the training



and indoctrination program for the Lunar TV Camera which is described in Section 13. They have had previous work with complex test equipment, test and inspection procedures, and test problem evaluation. Test procedures are coordinated with the test equipment design engineer during initial tool checkout for ease of operation and adequacy of details.

7.5 FABRICATION CONTROLS

7.5.1 Production Tooling and Fabrication Equipment

All tools, fixtures, jigs, or special fabrication equipment required for use on the Lunar TV Camera are inspected by Product Reliability prior to, during, and at the end of the production run. Before a tool or fixture is released for production use, a tool tryout is made. When the new tool is received in the tool room, a tool approval tag (Figure 7-7) is prepared and attached to the tool. At a designated time, the supervisor of the responsible area notifies the inspector that a tool tryout will be performed. The tool is removed from the crib and the operator using the tool fabricates a sample piece. The inspector and manufacturing engineer witnesses fabrication of the sample piece. When the piece is completed, the inspector checks the piece part per the applicable drawing. If acceptable, the Inspector, Foreman, and Manufacturing Engineer signs off the tool approval tag. The tool is then moved to the tool crib where issue is made for production use. All tools are identified.



TOOL NO.	DRAWING	SUB	ITEM	ORDER NO.
TOOL CONTACT MAN	TOOL MAKING DEPT	DEL TO TOOL CRIB		TOOL USED IN SECTION
INSPECTED BY	DATE INSPECTED			
COMMENTS				
TOOL USING DIVISION	ASSIGNED TO		DATE ASSIGNED	
INSPECTOR & DATE	TIME STUDY & DATE		CONTACT MAN & DATE	
TOOL APPROVAL TAG		RETAINED BY FAB. CONTACT MAN		
WESTINGHOUSE FORM 16277D				

395A1-VA11

Figure 7-7. Tool Approval Tag



First piece inspection is performed on the first production unit to further check on the accuracy of the tool and the individual operator's quality of work. The Area Inspector conducts periodic roving inspections to assure tool repeatability during use. When piece part dimensions indicate tool drift, production is stopped and the tool returned for repair.

7.5.2 Material Control

Raw materials are identified for Lunar TV use prior to being sent to the Lunar TV Camera bonded storeroom. Chemical and physical analysis data is required from each supplier. Samples are tested by Westinghouse for specification compliance, as necessary. Lot identification is established at receiving and the material or documentation stamped "Lunar TV" before moving to the storeroom. This identity is maintained when the material is issued to manufacturing for fabrication. Only material from the same lot is used for a single feeder item release.

Raw material specification and lot number are entered on the Feeder Inspection Control Tag (Figure 7-8) by the operator and first piece inspection checks identification compliance. Inspection and tests are performed to assure that items being processed are in conformance with drawings, specifications, station instructions, and required routing. All inspections and/or tests are recorded on the control tag. If an item is nonconfirming a Defective Apparatus Tag

[illegible]

Figure 7-8. Inspection Control Tag-Feeder



(Westinghouse Form BA5500) (Figure 14-2) is prepared and attached to the item. The defective material is removed from the area and dispositioned to scrap, rework, or MRB. (See Note)

Acceptable feeder items are sent to the camera assembly and test area together with the feeder inspection tag. Before the item is stored to await assembly, it is reinspected, cleaned, and packaged to maintain the required cleanliness.

Control of limited life material is audited by Product Reliability in the storerooms and work areas. Audit procedures are described in Section 15.

7.5.3 Control of Cleanliness of Fabrication and Test Spaces

The assembly, test, and storage of the Lunar TV Camera is performed in environmentally controlled areas. Temperature and humidity is controlled to meet, as a minimum, the cleanliness and environmental requirements specified in MSFC-PROC-158B where soldering operations are performed. Special station instructions are written to maintain the required cleanliness of the assembly and test area and the clothing of personnel working in the area. Product Reliability audits the clean room for compliance to the station instructions.

NOTE: Rework without MRB is described in paragraph 8.4.



Interior packaging of purchased parts and components are specified on the drawing or purchasing department specification. The material is of such composition to prevent contamination while being handled during inspection, test, and storage within the clean room. Other material entering the room is cleaned and/or has proper packaging prior to being accepted. Parts or subassemblies that are removed from the room for in-process operations are packaged to prevent contamination while outside the room. Instructions are given during the training program to all personnel responsible for maintaining the required cleanliness.

7.5.4 Process Control

Product Reliability maintains process control through area audits, evaluations on test samples of special processes, analysis of process solutions, and special tests of processes such as production pull tests of resistance spot welding.

Material and Processes Engineering prepares process specifications, and issues them directly to the individuals assigned process specification books. Product Reliability audits the process books in the manufacturing area during the area surveys. The audit determines if the revision sheet is up to date and that the latest revision is in the book. Configuration status of all process specifications is kept current by Product Reliability. Two master books are maintained for reference by Product Reliability Engineering.



Control of plating processes is maintained by process control tests performed by fabrication inspectors in accordance to station instructions prepared by Product Reliability Engineering. The tests include adhesion, corrosion, solderability, humidity, coating weight, etc. Plating solution analysis records are reviewed by the inspector. The schedule of solution analysis and qualification tests is maintained by Product Reliability.

Organic finish processes are also checked by testing sample panels per the established schedule. These tests include adhesion, film thickness, salt spray, and humidity. Color is determined by comparison to standard color panels.

Daily pull tests of resistance spot welding are performed by Product Reliability inspectors on sample welds made prior to the start of each shift. If they meet the tensile strength as specified in the process specification, the operator can continue.

Training and certification of fabrication and inspection personnel are described in Section 13.

7.5.4.1 Process Control Procedures

Process control procedures, in the form of inspection and test station instructions, are prepared by Product Reliability to supplement applicable process specifications designated by Engineering for Lunar TV Camera use. Records are maintained by Product



Reliability that indicate the results of inspections and process verification. Process specifications applicable to the Lunar TV Camera are submitted for NASA-MSD approval.

7.5.4.2 Process Environments

Processes which must be conducted under environmental conditions are monitored by use of indicating and/or measuring instruments. Calibration of these instruments on recording devices are the responsibility of Product Reliability.

7.5.4.3 Process Certification

All welding schedules for capacitor discharge resistance spot welding to be used in module construction are qualified prior to production welding. Qualification pull test data for the tensile test specimens is recorded on the Qualification Data Sheet, Q.A. Form 1405 (Figure 7-9). Tensile strength requirements are determined by Materials and Processes Engineering. Three specimens are cross-sectioned, polished, and viewed under 40X magnification by the inspector for compliance to process specification requirements. If all data and visual examinations are acceptable, the weld schedule is qualified. Daily pull test of production work is a further check of the machine and process certification. Condition of the welding electrodes is checked by roving inspection. A detailed procedure for capacitor discharge resistance spot welding is forwarded to NASA-MSD for their approval per paragraph 3.1.8 of the NASA-MSD Statement of Work.



Power Supply S/N	AA-	Welding Head No.																
Material:	to	Shape:																
Thickness:	to	Type of Joint:																
SCHEDULE QUALIFICATION DATA																		
CAPACITOR DISCHARGE RESISTANCE WELDING PROCESS (PS AA 293469)																		
MASTER SCHEDULE																		
		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 33%;">Tips</th> <th style="width: 33%;">Dia.</th> <th style="width: 33%;">Type</th> <th style="width: 33%;">Mat'l</th> </tr> <tr> <td>HEAT</td> <td>Watt-Secs</td> <td>Tap</td> <td></td> </tr> <tr> <td>PRESSURE</td> <td>Units</td> <td>Bot</td> <td></td> </tr> <tr> <td>Throat Opening</td> <td>Inches</td> <td>Special</td> <td></td> </tr> </table>	Tips	Dia.	Type	Mat'l	HEAT	Watt-Secs	Tap		PRESSURE	Units	Bot		Throat Opening	Inches	Special	
Tips	Dia.	Type	Mat'l															
HEAT	Watt-Secs	Tap																
PRESSURE	Units	Bot																
Throat Opening	Inches	Special																
MACHINE DATA																		
Manufacturer		Model No.																
Manufacturer S/N		Head Model No.																
Watt-Sec Meter S/N		Max. Rating																
TENSILE TEST EQUIPMENT																		
Manufacturer-Fixture		Tool No.																
Manufacturer-Dial Gage		Range																
CLEANING																		
Material and Thickness	Cleaning Process																	
TENSILE TEST SPECIMENS																		
1	6	11	16	Sum 1														
2	7	12	17	Sum 2														
3	8	13	18	Sum 3														
4	9	14	19	Sum 4														
5	10	15	20	Total														
Sum 1-	Sum 2-	Sum 3-	Sum 4-	Ave.														
80% of average _____		No. Specimens over 80% _____ (15 or more)																
70% of average _____		No. Specimens over 70% _____ (All)																
	External Defects	Internal Defects	Penetration															
1																		
2																		
3																		
Operator _____ Mfg. Foreman _____ Insp. _____ Gov't _____																		

Form QA #1405

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Figure 7-9. Schedule Qualification Data



Structural spot welding machines are qualified in conformance to the detail requirements of the Westinghouse specification which conforms to all requirements of the applicable government specification. Weld schedules are established for each type of metal or gage combination. Data, machine description, and schedules are documented by Product Reliability.

Certification of heat treat furnaces and qualification of furnace or dip brazing are the responsibility of Product Reliability. Records are maintained on the initial certification or on any re-certification.



SECTION 8

NONCONFORMING MATERIAL

8.1 MATERIAL REVIEW

Materials or articles which do not conform to drawings, specifications, or contractual requirements except as stated in paragraph 8.4 are submitted to a formal Material Review Board (MRB) for consideration and disposition.

Each MRB is composed of one Design representative, one Reliability Engineering representative, one Quality representative, and one Resident Government representative. Westinghouse MRB members are approved by the designated NASA-MSC representative. It is the duty of the MRB to make disposition of nonconforming material for use "as is", repair, or scrap, review or approve repair methods, and assure complete documentation of disposition and corrective actions taken.

Acceptance requires the concurrent of all members of the board. Rejection by any member constitutes rejection of the material. The board members signify concurrence by signing the MRB form (Figure 8-1) and copies are distributed. The Product Reliability member is responsible for distribution. Material accepted by the Material Review Board is identified with the "MRB approval" stamp when directed by the Material Review Board. When a repair procedure

[illegible]

Figure 8-1. Material Review Board



is involved, the Material Review Board directs that the material be resubmitted for inspection approval.

Product Reliability is responsible to assure that corrective action is instituted and that documentation specifies the person(s) responsible and date for completing the action. This responsibility includes follow-up to assure that corrective action has been completed and is effective.

Subcontractors shall submit to Westinghouse Aerospace Division their written plan for material review which shall be limited to minor or incidental nonconformances. Written requests for approval are required by Westinghouse Aerospace on all MRB dispositions where subcontractors may have affected safety, function, or interchangeability.

8.2 APPROVAL OF CONTRACTING OFFICER

Written requests for approval of the NASA contracting officer shall be made if a nonconformance may adversely affect safety, life, reliability, interchangeability, performance, weight, or the basic objectives of the contract.

8.3 CONTROL OF NONCONFORMING MATERIAL

Westinghouse Aerospace provides a bonded room for the segregation and positive identification of nonconforming items. A copy of the MRB form is retained on file and another copy kept with the



article. All pertinent data as to the nature and cause of the defect, disposition, and action of the MRB is documented by the MRB form. The material is stamped "MRB approval" where physically practical.

8.4 REWORK WITHOUT MRB

Disposition of nonconforming material, in the categories below, is disposed of or reworked without formal MRB procedure:

- a. Material obviously unfit for use and not reparable is scrapped.
- b. Material rejected for "Missed Operations" is returned for completion.
- c. Materials rejected for nonconformance that can be "reworked to drawing".

These dispositions are authorized by Product Reliability and documented on the Inspection Control Tag, Error Correction Tag and/or Defective Apparatus Tag. Written procedures define the types of rework in these categories and the reinspection necessary to ensure that reworked material meets drawing and specification requirements.



SECTION 9

INSPECTION, MEASURING, AND TEST EQUIPMENT

9.1 GENERAL

Westinghouse Aerospace procedures for calibration of gages, instruments, and special test equipment assures compliance to the drawings, specifications, and contract requirements for the Lunar TV Camera. Use is made of the existing in-plant laboratories and standards traceable to the National Bureau of Standards to control the accuracy of items used on this program.

The Product Reliability audit team monitors and evaluates the effectiveness of the calibration laboratories and their support of the Lunar TV Camera program.

9.2 CALIBRATION

All inspection, measuring, and test equipment used on the Lunar TV Camera is calibrated prior to its use on this program and re-calibrated at scheduled intervals thereafter. A calibration sticker indicating date calibration was performed, calibration due date, and serial number of the equipment is attached to a prominent area of all instruments.

Identifications as to calibration status is attached to gages. A master file on all gages is kept in the gage laboratory for recording the calibration status and due date of each gage. This



file is checked weekly for gages nearing their calibration due date. At least 6 days prior to the due date a list of gages due calibration is given to the tool crib Foreman. The tool crib Foreman prepares a Calibration Notice Form BA-5209 (Figure 9-1) in duplicate and forwards one copy to the Foreman of the person on record of having received the gage. The remaining copy is given to the gage laboratory Inspector. Tools, gages, jigs, or fixtures are inspected and subjected to periodic checks and calibration to assure continued accuracy.

9.3 CALIBRATION FACILITIES AND STANDARDS

Westinghouse Aerospace uses existing in-plant laboratories for the inspection and/or calibration of measuring and test equipment. These facilities have a maintained environment compatible with the accuracy and design characteristics of standards used for calibration and equipment being calibrated. The accuracy of standards used by these laboratory facilities is traceable to the National Bureau of Standards. Standards provided to Westinghouse laboratories are of realistic value in determining the accuracy of inspection and/or production measuring and test equipment. Where technically and economically feasible, the standards used for calibration of inspection, measuring, and test equipment has a tolerance no greater than 10 per cent of the allowable tolerance for the equipment being calibrated. Where state of the art limitations are being



FORM BA 0002

CALIBRATION NOTICE

FOREMAN	SECTION	Mail Stop	DATE
TOOL NO.	Date DUE FOR CALIBRATION	CHARGED TO	Name
TOOL NAME		LOCATION	Date

TOOL MUST BE RETURNED TO
CRIB BY

REMARKS (Trouble Description, Etc.)	LOCATED Foreman Calibration
-------------------------------------	--------------------------------

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Figure 9-1. Calibration Notice



realized, the best ratio available is utilized. NASA-MSC or its designated representative is supplied a list of any calibration standards that have a tolerance greater than 10 per cent of the equipment being calibrated.

9.4 EVALUATION

Test equipment required to functionally test components, sub-assemblies, and the completed camera is fabricated, wired, and electrically checked before production units for the Lunar TV Cameras are tested with these tools.

The Engineering Department defines the test requirements and releases this information to the Product Support Equipment Design Engineering. Close liaison is maintained between Engineering and the Product Support Design group. Meetings are held, with Product Reliability present, during the design phase of the camera to discuss test philosophy, packaging, interface information for test tool connections, standardization of pin sizes and locations, reliability and quality considerations, safety, human factors considerations for ease of the test operator, etc.

The test equipment for the camera program is designed and fabricated per the General Specification for Support Equipment (DSC-SP-1000) dated June 1, 1964. A copy of this specification was included in the 18 December 1964 edition of this plan.



Steps are taken during tool design to prevent degradation to the item under test due to improper test voltages, transients, damage to electrical connections, improper sequence of switching, and incorrect handling.

During the initial checkout of the test tool, an operating test specification is written by the test tool design engineer for the test equipment. This specification contains the following:

- a. General description of the test tool
- b. Specification for test tool
 - 1. Description of test fixture
 - 2. Test equipment including commercial equipment
 - 3. Test requirements
- c. Acceptance test procedure (detailed procedure for operation of the test tool with clearly defined steps to prevent misinterpretation of switch positions, range of meters, etc.).
- d. Data sheet
- e. Revision sheet

The specification incorporates all the electrical parameters that have been specified by the Project Design Engineers in the test requirements specification. Project Engineering approves the operational test specification prior to its release. In addition, a maintenance and calibration procedure (MC Spec) is prepared by the test equipment design engineers.



The MC Spec outlines the procedures to be followed in calibrating a specific test set and is subdivided into the following sections:

General Purpose

References

Description

Theory of Operation

Alignment and Checkout Procedure

Calibration

Maintenance

Revisions

All test equipment is calibrated and the readings documented during tool checkout. Schedule for periodic calibrations is established at the time of initial acceptance of the tool. The Revision Notice (described in Section 2) is used to authorize changes to the test equipment, tool drawings, operational test specification, and maintenance and calibration procedure. Configuration control of all test tools, drawings, specifications, and procedures are the responsibility of Product Reliability.

Final acceptance of each item of test equipment is made by Product Reliability when the first production article has passed all the electrical requirements. Any changes that may be required to the operational test specification is coordinated with the tool design engineer at this time. Test equipment performance is



demonstrated for NASA or its designated representative upon request.

The special test equipment is identified by name, tool drawing number, and serial number.

Commercial test equipment and special equipment evaluation and calibration is monitored by Product Reliability Engineering. Test specifications defining the use of such equipment is reviewed and evaluated by Product Reliability Engineering.

All documentation of the test equipment evaluation pertaining to the calibration and special tests is submitted to NASA-MSC for information.

9.5 MAINTENANCE AND CONTROL

All inspection and test equipment used is inspected, maintained, and calibrated to an established schedule. If the need arises, the frequency of the calibration is shortened. Normally, frequency of inspection, maintenance, and/or calibration is based on accumulated data. This takes into consideration the type of equipment, required accuracy or precision wearlife, and intended usage and other related characteristics.

If the inspection, measuring, or test equipment is found to be defective during actual use, a service request form (Westinghouse form number 32545) (Figure 9-2) is filled out and attached to the defective equipment. The Calibration Department is notified and the



WESTINGHOUSE FORM 32545		WHITE - FOREMAN BLUE - QUALITY ANALYSIS TAG - ATTACH TO UNIT	
SERVICE REQUEST - TEST EQUIPMENT			
DATE		EQUIPMENT CODE NO.	
EQUIPMENT NAME		MODEL NO.	
MANUFACTURER		MFG. CODE NO.	
DEFECT			
ISSUING TESTER		SECTION	
SPACE BELOW FOR REPAIRMAN'S USE ONLY			
DEFECT CODE	DEFECT CODE	DEFECT CODE	
REPLACEMENTS	REPLACEMENTS	REPLACEMENTS	
REPAIR TIME		DATE	
RECEIVING TECHNICIAN		STAMP NO.	

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Figure 9-2. Service Request - Test Equipment



instrument is removed for repair. If for any reason the calibration due date has expired, a red hold tag (Westinghouse form 211528) (Figure 9-3) is attached to the instrument or gage by the inspector or reliability technician. Usage of the equipment is immediately stopped and the Calibration Department is notified.

9.6 WRITTEN PROCEDURES

Product Reliability Engineering generates the procedures for the calibration and control of the calibration laboratories whose function is to inspect and/or calibrate measuring and test equipment. These procedures conform to MIL-C-45662A and USAF Bulletin NR520. They are detailed in the Aerospace Calibration Handbook and Physical Measurements Handbook. These procedures are used on the Lunar TV Camera program as applicable. Special procedures are written where required by special calibration requirement not already documented. All the procedures are available to the NASA-MSC representative.

9.7 RECORDS

Calibration records are identifiable to the specific item listing the description, serial number, control number, manufacturer's name, date required, date inspected and calibrated, condition, repairs made, inspected by, and other information pertinent to the maintenance of records. Periodic audits and surveys by Product Reliability are made to determine adequacy of the established inspection and calibration time intervals.



HOLD — DO NOT USE THIS MATERIAL	
<input type="checkbox"/> AWAITING INSPECTION	MATERIAL RELEASED BY _____ DATE _____
<input type="checkbox"/> AWAITING LABORATORY REPORT	
<input type="checkbox"/> AWAITING CUSTOMER'S INSPECTION	
<input type="checkbox"/> AWAITING IDENTIFICATION	
<input type="checkbox"/> MATERIAL DIFFERS FROM STANDARD SPECIFICATIONS IN FOLLOWING RESPECTS :	

INSPECTOR _____ DATE _____	
WESTINGHOUSE FORM 21152B	

395A1 - VA10

Figure 9-3. Hold Tag



SECTION 10
INSPECTION STAMPS

10.1 GENERAL

Product Reliability Operations issues and controls inspection and test stamps. Quality control stamps are used to indicate acceptance of piece parts, subassemblies, major assemblies, and systems. The identity of the inspector or technician using a stamp is determined from the number on the stamp. The design of the stamp meets existing Government regulations.

10.2 TYPES OF STAMPS AND USAGE

Five types of stamps are used for approval of articles used on the Lunar TV Camera program.

- a. Mechanical Inspection Stamp - used by inspectors to indicate acceptance of the mechanical inspection of parts and assemblies.



- b. Test Stamp - used by the reliability technician to indicate successful completion of circuit check or test in accordance with specification requirements.



- c. Special Process Stamps - used by inspectors to indicate a part or assembly has successfully passed penetrant inspection, pressure test, heat treat, etc.





- d. MRP Approval Stamp - used by the Material Review Board to designate approval of MRP forms and/or material according to material review procedure. This stamp is issued to Product Reliability MRP member only.



- e. Field Q.C. Stamp - used by Quality Control Engineers at the vendors plant to indicate that a part or assembly has been successfully tested and/or inspected under their cognizance.



Stamps indicating completion of specified inspection are applied directly to the article with exception of the MRP stamp. Present procedures for use of the stamp on the accompanying travel tag with the article has proven satisfactory.

10.3 ISSUE OF STAMPS

A written request from the inspection or test foreman is required before a new stamp is issued to a new tester or inspector, replace a lost stamp, or replace a damaged stamp. The Supervisor of Product Reliability Operations honors the above request for issuance of a new stamp.

10.4 CONTROL OF STAMP

The inspection or test foreman posts a list of each employee and their assigned stamp number. Stamps are returned to Product



Reliability Operations Section whenever a reliability technician or inspector transfers from the Product Reliability Department or leaves the Westinghouse Aerospace Division. Returned stamps are held in bond for a minimum of 6 months before reissue to another inspector or reliability technician.

SECTION 11

PRESERVATION, PACKING, HANDLING, STORAGE, AND SHIPPING

11.1 GENERAL

Written procedures for preservation, packaging, handling, storage, and shipment are prepared where:

- a. There is no existing MIL/industry specifications or procedures available.
- b. Westinghouse Aerospace determines that conditions are of such a critical nature that the quality/reliability of the item is jeopardized.

All procedures are reviewed by Product Reliability prior to their implementation.

11.2 PRESERVATION

Parts subject to deterioration through exposure to the elements during manufacture, storage, etc. are preserved by an approved method. Equipment packaged for shipment is preserved in compliance with the specified requirements. Product Reliability audits ensure that the preservation requirements are as specified and adequate.

11.3 PACKAGING

Packaging requirements includes suitable protection of materials, parts, and equipment purchased or manufactured by Westinghouse for delivery to NASA-MSC. Finished subassemblies



that have completed fabrication and have passed inspection are packaged and sealed in a clean dust proof container prior to entering the clean room assembly area. All units remain in containers until removal for assembly.

11.4 HANDLING

Westinghouse Aerospace provides special handling for articles which are susceptible to handling damage. Special procedures are written by Product Reliability defining the proper handling technique to be used by the storeroom attendant, fabrication personnel, assembler, tester, and shipping department personnel. During fabrication and processing, as necessary, special carts, boxes, containers, and transportation vehicles are used to prevent handling damage. Those stations and test sites requiring special handling procedures are supplied copies of these instructions.

Special handling procedures are reviewed by Product Reliability, Packaging Engineering, and Manufacturing Engineering. Quality audits check compliance to this procedure.

11.5 STORAGE

Parts and equipment to be stored are protected against damage. Storage instructions include provisions for safety, preventative maintenance, and periodic inspection. Storage procedures are reviewed by Product Reliability. Periodic surveys are conducted by Product Reliability Engineering to determine that the stored parts have not exceeded their shelf life and that the storage temperature is correct.



11.6 SHIPPING

Prior to shipment, Westinghouse inspection personnel assure that:

- a. All articles have satisfactorily passed all inspections and tests. Evidence of such inspections and tests must appear upon the accompanying documentation.
- b. Parts or equipment are complete and of the proper configuration.
- c. Adequate preservation and packaging has been accomplished.
- d. Identification has been documented as required by specifications.
- e. Shipments contain documentation as specified in NASA-MSC's "Acceptance Data Package Requirements".
- f. Container is properly marked as to fragility, special storage, or environmental requirements, etc.
- g. Contractual requirements are complete or deviations/ waivers have been NASA-MSC approved.

Detailed station instructions written by Product Reliability supplementing the above information to ensure the safe delivery of the equipment to NASA-MSC.



SECTION 12

STATISTICAL PLANNING, ANALYSIS, AND QUALITY CONTROL

12.1 GENERAL

Westinghouse Aerospace uses statistical planning, analysis, test, and quality procedures whenever such procedures are advantageous in maintaining the required controls. Statistical procedures are subject to review and evaluation by Product Reliability and Reliability personnel.

12.2 STATISTICAL ANALYSIS AND TEST PLANNING

Statistical test planning is utilized during the development and fabrication stages. A Product Reliability Engineer works closely with the design engineers. Information gathered early in the program enables the engineer to formulate test procedures, inspection techniques, and test tool requirements required to maintain the controls.

12.3 SAMPLING PLANS

All electrical and mechanical parameters having critical characteristics are inspected/tested 100 per cent. Sampling inspection/test is used where tests are destructive or the parameters have non-critical application and a reduction in inspection or testing will not jeopardize part quality or reliability. Sampling inspection/test is performed in accordance with MIL-STD-105



or MIL-STD-414. Any special sampling plans are submitted for NASA review.

12.4 STATISTICAL QUALITY CONTROL CHARTS

Control charts are prepared by Product Reliability and used where they provide effective control over the quality of the Lunar TV Camera. Posted data is compiled from various quality control documents. Control limits are the responsibility of the Product Reliability Department.

SECTION 13

TRAINING AND CERTIFICATION OF PERSONNEL

13.1 TRAINING

Under the direction of Product Reliability, all Manufacturing and Product Reliability personnel assigned to the Lunar TV Camera Program are subjected to an orientation program prior to performing work on the program. This orientation is to assure their understanding of the reliability and quality goals and how individual contributions aid in achieving these goals. Upon completion, special badges are issued to be worn for identification to the Lunar TV Camera Program.

Orientation and training includes familiarization with the functions of parts, components, and subsystems, a description of the Lunar TV Camera system in operation, tying it to the Apollo Program and its mission, and periodic meetings to inform personnel of new developments in the program and of program progress.

Additional motivational programs are scheduled periodically to assure that personnel performing the manufacturing and test operations are continuously motivated as to the high reliability and quality requirements of this program and the important part each individual plays in the team effort required for a successful mission.



The Product Reliability Operations Section maintains a training schedule for all receiving, fabrication, and assembly inspectors that runs concurrent for an 8 month period each year and is attended weekly. The course embraces all phases of inspection through the use of quality control procedures, excerpts from the quality control manual, process specifications, general and specific inspection technique demonstrations, and films. A series of tests and essays are conducted at specific intervals to determine training content effectiveness and to measure individual progress of material acceptance.

All inspectors assigned to the Lunar TV Camera Program have attended, and are presently attending these training classes.

13.2 CERTIFICATION OF MANUFACTURING AND INSPECTION PERSONNEL

All personnel engaged in fabrication, assembly, and inspection of the Lunar TV Camera are certified per procedure MSFC 158B (soldering) prior to performing work on the service models, prototype models, and qualified models. A certified instructor (Category II) conducted a training program based on the requirements of the MSFC 158B specification. The training program, controls, and personnel are subject to Government approval before certification is issued. At the completion of the training program, a test specimen is fabricated in the presence of a Category II Instructor.



After the trainee has demonstrated his ability to the satisfaction of the instructor, a certificate is issued. The trainees are certified as Category III Operator/Inspector. This certificate is void 12 months after the date of the last entry or at any time that the work is unsatisfactory. An operator may retain his certified status by successfully completing re-examination tests every 12 months or by a continuing record of satisfactory workmanship.

Personnel performing special operations such as fusion welding, resistance wire welding, x-ray, and penetrant inspection are trained and tested in their proficiency in performing these operations. These personnel are issued cards as evidence of certification to be carried while performing these operations.

The Product Reliability Department maintains records of all personnel registering for certification, certification date, and if applicable, date re-certification is due and course attended.

SECTION 14

DATA REPORTING AND CORRECTIVE ACTION

14.1 GENERAL

Procedures are established and maintained to provide for the collection, analysis, and reporting of all trouble, failure, and quality data resulting from inspection, testing, and usage of all articles procured or produced. These procedures are implemented to achieve maximum knowledge of quality and reliability problems, and include effective follow-up to ensure expedient feedback of information and corrective action.

14.2 DATA REPORTING

Complete records of failure and quality data is maintained throughout the receiving, manufacturing, assembly, and test processes. This data is analyzed and disseminated in a minimum of time to all pertinent areas in-plant, to the suppliers concerned, and to NASA as required by contract.

14.2.1 Monthly Quality Status Report

Westinghouse Product Reliability compiles narrative comments, recommendations, tabulations of pertinent data, and summaries of those corrective actions accomplished and those incomplete. This data is submitted monthly to NASA-MSC for information per the established schedule in Appendix A.



14.2.2 Laboratory and Experimental Data

Data collected from all laboratory tests, qualification tests, evaluations, and failure analysis includes the part, component, or system identification, type of test, description of failures, numerical test results, other pertinent or necessary data, recommendations, and corrective actions. This data is incorporated into reports and/or available for review as required.

14.2.3 Quality Data

Westinghouse maintains records of inspections and tests performed during the development, fabrication, assembly, and test processes. The records provide evidence that the required inspections and tests have been performed and that conformance was verified. These procedures are described in Section 7 of this plan.

Discrepancies and failures are recorded by inspector/testers at the inspection or test station where the nonconformity occurs. These records indicate material identification, the inspection or test involved, the number of items conforming and rejected, and a clear description of the discrepancy that will enable analysis. The following forms are used to report discrepancy data:

Material Rejection Notice (MRN), Form W99565 (Figure 14-1) is issued by receiving inspection for purchase items.

Defective Apparatus Tag (D.A.), Form BA5500 (Figure 14-2) is issued by fabrication and assembly inspectors for mechanical discrepancies.



MATERIAL REJECTION NOTICE <small>WESTINGHOUSE FORM 9990-0</small>		NO MATERIAL TO BE RETURNED WITHOUT PROPER AUTHORIZATION	
DISPOSITION REQUIRED <input type="checkbox"/>		FOR INFORMATION ONLY <input type="checkbox"/>	
SUPPLIER OR SUPPLYING LOCATION		No.297628	
STYLE, PATTERN, SIZE, L. SPEC.		DATE MATERIAL REC'D.	
DRAWING AND ITEM		ORIGINAL REQ. OR PURCH. ORDER NO.	
QUANTITY RECEIVED		P. D. SPEC. OR M. NO.	
QUANTITY REJECTED		MATERIAL FOR USE ON L. O. NO.	
REASON FOR REJECTION		D. A. TAG NO.	
Empty space for reason for rejection			
REPLACE REQ. NO. — IF NONE — WHY?		LOCATION OF MATERIAL	
INSPECTED BY		DATE INSPECTED	
OF DIV. WKS. OR M & S PLANT		CHIEF INSPECTOR	
Empty space for inspector name		OF DIV. WKS. OR M & S PLANT MATERIALS SECTION	
DISPOSITION:			
Empty space for disposition			
ORDER NO. OR SE. NO.		DISPOSITION AUTHORIZED BY	
Empty space for order no		OF DIV. WKS., OR M & S PLANT	
Empty space for authorized by		DATE AUTHORIZED	
Empty space for date authorized		Empty space for date authorized	

TO REQUISITIONING DEPT. (FOR ATTACHMENT TO REPLACE REQUISITION WHEN REQUIRED)

395A1-V817

Figure 14-1. Material Rejection Notice




DA SALVAGE TAG		INTERNATIONAL TAG-CR66		MAKE ALL COPIES LEGIBLE		
WESTINGHOUSE ELECT. CORP. DEFENSE AND SPACE CENTER BA 8800				PINK - INSP. DEPT. TAG - MATERIAL		
GREEN - ACCTG. DEPT. WHITE - PROD. DEPT.						
REJECT <input type="checkbox"/>		REPAIR <input checked="" type="checkbox"/>		SALVAGE <input type="checkbox"/>		
		RETURN TO SUPPLIER STOREROOM <input type="checkbox"/>				
DA A 8955	DATE		S. O.		ASSD. ITEM	
	QUANTITY		APPARATUS			
	DRAWING NO.		ITEM		DELIVER TO SEC.	
	SIZE, STYLE, SER. NO. OR P. D. SPEC.				REPAIR IN SEC.	
	SUPPLIER					
	P. O. I. W. R.		MRN MRB		MOVE TO SEC.	
	CHARGE NUMBER		CONTROL FIELD			
	REVISED SUB TYPE		FROM SECTION			
	DEFECT					
ISSUING INSPECTOR		DATE		ISSUING FOREMAN		
MFG. SEC. INSPECTOR		DATE		RESPONSIBLE FOREMAN		
PRODUCTION CLERK		DATE		ACCTG. DEPT.		
OPERATIONS PERFORMED NOS.		OPERATION DEFECTIVE NO.				
CORRECTIVE ACTION						
SIGNATURE						
REPAIR SATISFACTORILY MADE						
INSPECTOR		STAMP		DATE		
DA						

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Figure 14-2. DA Salvage Tag





ALL FAILED PARTS LISTED

REPORT ONLY ONE PRIMARY DISCREPANCY (INCLUDE SECONDARY EFFECTS) PLEASE PRINT - BLANK DOWNS (IF ANY)

MUST REMAIN WITH TAG

FALLS YELLOW - PPOD EL - BACA

PAGE 1

PRODUCT

PPOD EL

BACA

DISCREPANCY REPORT

REPORTING ACTIVITY

DATE

LOCATION

REPORT NO. **K74**

UNIT LEVEL	NAME	MODEL DESIGNATING BEARING NO. PC CODE	SERIAL NO. ORIGINAL UNIT	REFERENCE DESIGNATION (INCLUDE POSITION NO. AND CIRCUIT SYMBOL)	OPERATING TIME	METER	ESTIMATE	UNIT
A SYSTEM			0		0			0
B ASST			0		0			0
C			0		0			0
D			0		0			0
E			0		0			0
F			0		0			0
G			0		0			0
H			0		0			0
I			0		0			0
J			0		0			0
K			0		0			0
L			0		0			0
M			0		0			0
N			0		0			0
O			0		0			0
P			0		0			0
Q			0		0			0
R			0		0			0
S			0		0			0
T			0		0			0
U			0		0			0
V			0		0			0
W			0		0			0
X			0		0			0
Y			0		0			0
Z			0		0			0

10 SHOP ORDER NO.

11 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

12 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

13 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

14 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

15 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

16 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

17 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

18 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

19 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

20 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

21 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

22 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

23 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

24 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

25 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

26 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

27 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

28 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

29 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

30 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

31 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

32 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

33 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

34 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

35 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

36 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

37 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

38 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

39 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

40 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

41 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

42 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

43 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

44 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

45 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

46 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

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99 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

100 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

10 SHOP ORDER NO.

11 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

12 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

13 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

14 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

15 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

16 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

17 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

18 DISCREPANCY EFFECTS (SEE INSTRUCTIONS)

19 DISCREPANCY EFFECTS (SEE INSTRUCTIONS

Figure 14-3. Discrepancy Report




WESTINGHOUSE FORM 18117B				ERROR CORRECTION	
INT'L TAG NO.				FOR USE ONLY IN LOCAL DEPARTMENT. TAG NOT A BASIS FOR PAYMENT.	
ORDER NO.		STYLE NO.			
L-SPEC.		SERIAL NO.			
DRAWING NO.		SUB		ITEM	
QUANT.	APPARATUS				
DEFECT					
OPERATION NO.		CK. OR GR. NO.		DATE	
INSPECTOR-TESTER		FOREMAN			
		DEPARTMENT			
Nº 776945					

Figure 14-4. Error Correction 1955A-PF-9



Discrepancy Report (D.R.), Form BA5144 (Figure 14-3) is issued by testers for electrical and other discrepancies requiring extensive analysis.

Error Correction Tag (E.C.), Form 18117B (Figure 14-4). The fabrication, assembly, and test sections issue the E.C. Tag to review and accomplish rework which does not effect safety, reliability, durability, performance, and interchangeability of parts or the basic objectives of the program. The D.A. and D.R. documents may also be used for rework authorization.

Product Reliability Station Instructions cover the use and control of the above forms.

14.2.4 Narrative End-Item Report

Westinghouse prepares and submits to NASA-MSC, a narrative end-item report for each Lunar TV Camera submitted under the contract schedule. The report covers the periods from subassembly installation through shipping and includes the following data.

- a. Optical alignment check
- b. Subsystems test
- c. End-item test and inspection
- d. Weight
- e. Center of gravity
- f. Model and serial number of the Camera
- g. Commentary on the final configuration



- h. Serial and part numbers of serialized items replaced during test and final checkout. This includes both the removed and substituted. Unserialized parts are identified by lot number.
- i. Extent of retests conducted after final test and inspection
- j. Nature of troubles and malfunctions encountered
- k. Corrective action taken or pending
- l. Total operating hours for each Camera
- m. Other data necessary for proper identification, checkout, and inspection of the Camera for reliable operational performance.

14.2.5 Operational Data

The recording and submission of all operation data is accomplished by the system equipment log and its supporting data sheets as described in Section 7 of this plan.

14.3 CORRECTIVE ACTION

Westinghouse operates an extensive program to feed back information and take corrective action to prevent the recurrence of malfunctions, deficiencies, and failures. Product Reliability conducts periodic reviews to determine the effectiveness of corrective action procedures and takes action to correct deficiencies. The system of discrepancy reporting, analysis, corrective action and follow-up is diagramed in Figures 14-5 and 14-6.

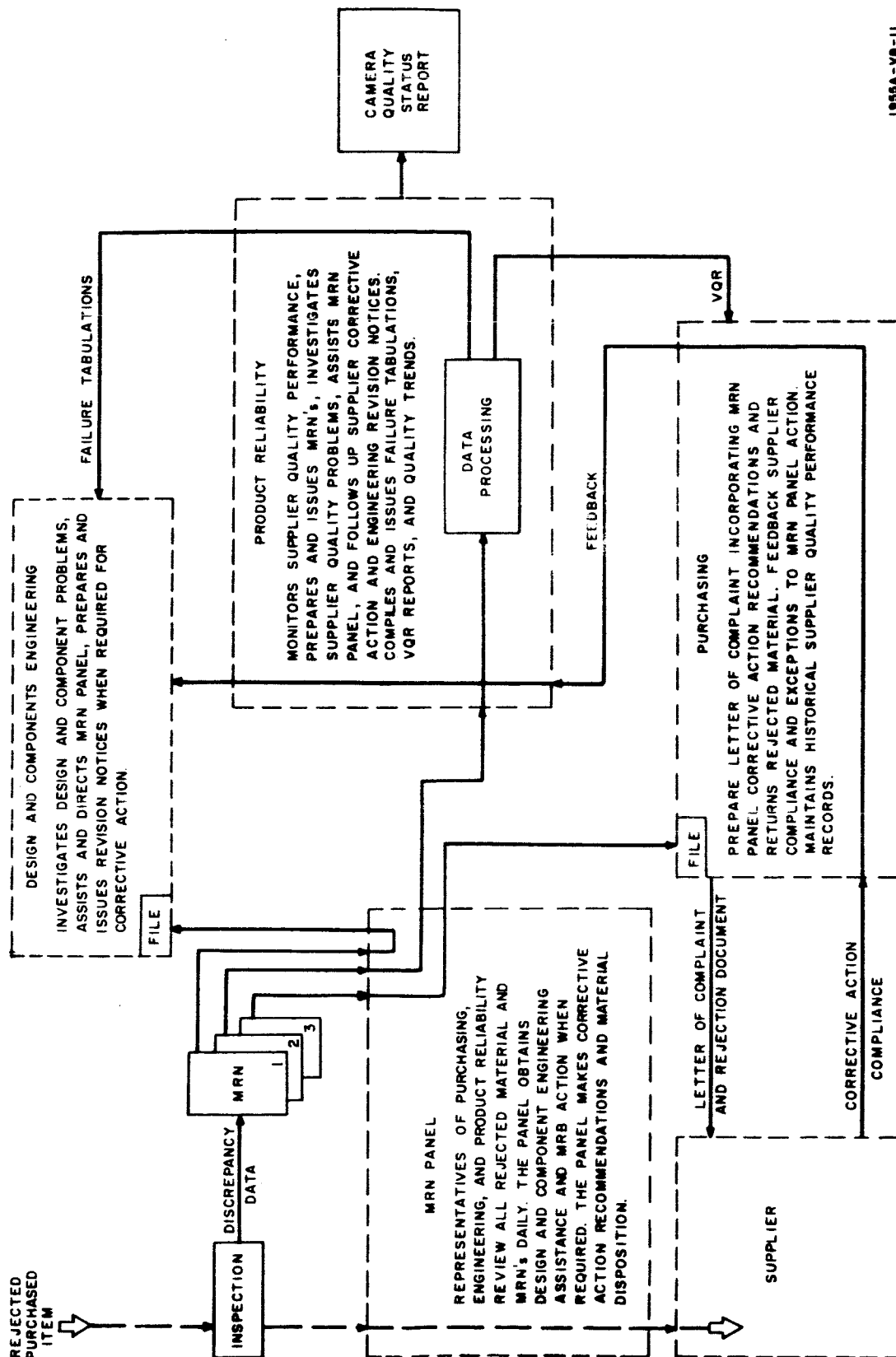


Figure 14-5. Discrepancy Data Reporting for Nonconforming Purchased Items

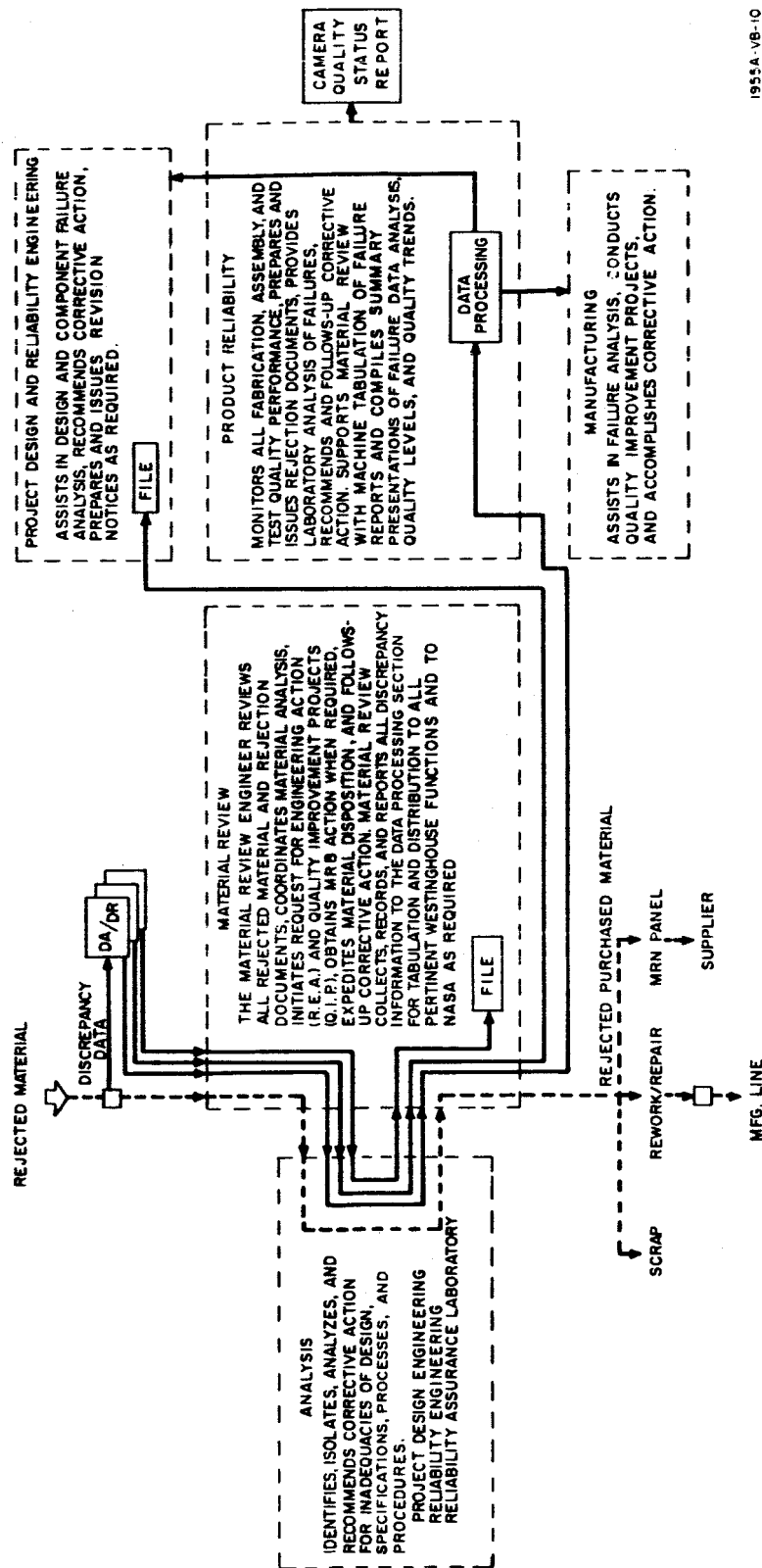


Figure 14-6. Feeder - Assembly - Test Discrepancy Data Reporting



SECTION 15

AUDIT OF QUALITY PROGRAM PERFORMANCE

15.1 PERFORMANCE OF AUDITS

All quality audits for the Lunar TV Camera are performed by the Reliability Assurance Section of Product Reliability. Their function is to monitor and audit the reliability and product effectiveness of Aerospace Division products. The audits serve to inform management of deficiencies encountered, recommended corrective action, and to monitor corrective action taken. Audits are conducted on an unannounced basis.

Audits of the Manufacturing and Inspection Departments are divided into two areas, product and process audits. Areas are checked as a minimum for:

- a. Safety
- b. Equipment calibration current
- c. Records and charts current and in control
- d. Material handling, packaging, and storage
- e. Inspection control tags complete and current
- f. Test and process specification books up to date, and special quality requirements specific to the area (i.e., clean room requirement).

An audit report is filled out and distribution made to the supervisor, general foreman, and inspection or test supervisors.



Product Reliability is responsible for follow-up of corrective action taken to correct deficiencies.

Product audits are performed on subassemblies and major assemblies selected at random after having passed inspection. The product audit provides a periodic check on manufacturing operations and the effectiveness of product reliability inspectors. The assembly selected is reinspected to assure conformance to engineering drawings, specifications, workmanship standards, etc. An audit report is made and distributed to appropriate management. Corrective action, responsibility, and effective date of action on any discrepancies is determined by the Superintendent of Manufacturing or the Product Reliability Director.

The process audit provides a scheduled periodic check of assembly and fabrication processes in order to monitor conformance to process specifications. Section inspectors are required to reaffirm that the details of the specification are being adhered to. The foreman in charge of the process is responsible for any corrective action.

15.2 AUDIT REPORTS AND CORRECTIVE ACTION

Results of audits in each applicable area used during the Lunar TV Camera's manufacture are prepared in report form and sent to program management. Copies are available for review by NASA-MSC. Action is taken by Aerospace management to correct



deficiencies and follow-up reviews are made.

Summaries of quality program performance audits and results of reviews of deficient areas found during quality audits are forwarded quarterly to NASA-MSC for information.



APPENDIX A

PROGRAM DOCUMENTATION

The following documentation is submitted to NASA-MSC
as a Class I (approval) document.

- | | |
|---|--|
| a. Quality Program Plan | Para. 3.1 of NPC 200-2 |
| b. Capacitor Discharge Resistance
Spot Welding Process | Para. 3.1.8 of NASA Statement
of Work |
| c. Process Specifications | Para. 3.1 of NASA Statement
of Work |

The following documentation is submitted to NASA-MSC
as a Class II (review) document.

- | | |
|---|---------------------------------|
| a. Qualification Status List
(prepared and submitted by
Reliability Engineering, Ref.
Para. 5.3.1.2 of Reliability Plan) | <u>NPC 200-2</u>
Para. 4.3.5 |
| b. End-Item Test Plan | Para. 7.4.2.1 |
| c. End-Item Test and Inspection
Procedures | Para. 7.4.2.2 |
| d. Storage Procedures for End-Items | Para. 11.5 |
| e. Acceptance Data Package | Para. 11.6.f |
| f. Narrative End Item Report | Para. 14.2.4 |

The following documentation is submitted to NASA-MSC
as a Class III (information) document.

- | | |
|-----------------------------------|-------------|
| a. Test and Inspection Procedures | Para. 7.3.1 |
| b. Process Control Procedures | Para. 7.5.4 |

NPC 200-2

- c. Special Sampling Plans Para. 12.3
- d. Monthly Quality Status Report Para. 14.2.1
- e. Results of Special Measuring and
Test Equipment Evaluations Para. 9.4
- f. Quarterly summaries of Quality
Program Performance Audits and
results of reviews of deficient
areas found during Quality Audits. Para. 15.2



		1964			1965												1966						
TYPE	DOCUMENT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	
I	QUALITY PROGRAM PLAN		Δ																				
I	EQUIPMENT LOG FORMAT		Δ																				
I	PROCESS SPECIFICATIONS								Δ-----Δ														
II	QUALIFICATION STATUS LIST								Δ														
II	END ITEM TEST PLAN																						
II	END ITEM TEST & INSPECTION PROCEDURES								Δ-----Δ														
II	STORAGE PROCEDURES FOR END ITEMS								Δ														
II	TECHNICAL DATA (STM NO. 1 ONLY)									Δ													
II	ACCEPTANCE DATA PACKAGE																						
II	NARRATIVE END ITEM REPORT																						
III	MONTHLY QUALITY STATUS REPORT				Δ		Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ	Δ			
III	QUARTERLY SUMMARY OF QUALITY AUDITS																						
III	TEST AND INSPECTION PROCEDURES																						
III	PROCESS CONTROL PROCEDURES								Δ-----Δ														
III	RESULTS OF SPECIAL MEASURING & TEST EQUIPMENT EVALUATION									Δ													
III	RESULTS OF REVIEWS OF DEFICIENT AREAS FOUND DURING QUALITY AUDITS																						

1955A-V8-18

Schedule for Submission of Documents